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Includes aeronautics (general); aerodynamics; air transportation and safety; aircraft communications and navigation; aircraft design, testing and performance; aircraft instrumentation; aircraft propulsion and power; aircraft stability and control; and research and support facilities (air).

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ASTRONAUTICS

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Includes social sciences (general); administration and management; documentation and information science; economics and cost analysis; law, political science, and space policy; and urban technology and transportation.

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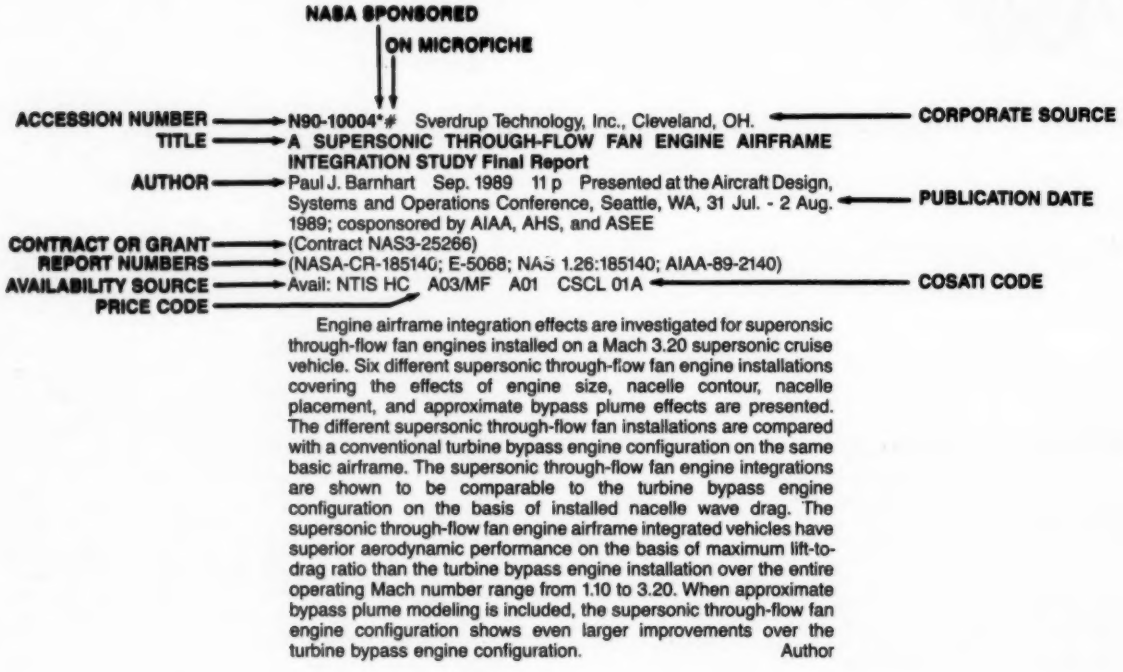
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ACCESSION NUMBER
N90-10004*# Sverdrup Technology, Inc., Cleveland, OH.
CORPORATE SOURCE
TITLE
A SUPERSONIC THROUGH-FLOW FAN ENGINE AIRFRAME INTEGRATION STUDY Final Report
AUTHOR
Paul J. Barnhart Sep. 1989 11 p Presented at the Aircraft Design, Systems and Operations Conference, Seattle, WA, 31 Jul. - 2 Aug. 1989; cosponsored by AIAA, AHS, and ASEE
PUBLICATION DATE
CONTRACT OR GRANT
(Contract NAS3-25266)
REPORT NUMBERS
(NASA-CR-185140; E-5068; NAS 1.26:185140; AIAA-89-2140)
AVAILABILITY SOURCE
Avail: NTIS HC A03/MF A01 CSCL 01A
COSATI CODE
PRICE CODE
Engine airframe integration effects are investigated for superonsic through-flow fan engines installed on a Mach 3.20 supersonic cruise vehicle. Six different supersonic through-flow fan engine installations covering the effects of engine size, nacelle contour, nacelle placement, and approximate bypass plume effects are presented. The different supersonic through-flow fan installations are compared with a conventional turbine bypass engine configuration on the same basic airframe. The supersonic through-flow fan engine integrations are shown to be comparable to the turbine bypass engine configuration on the basis of installed nacelle wave drag. The supersonic through-flow fan engine airframe integrated vehicles have superior aerodynamic performance on the basis of maximum lift-to-drag ratio than the turbine bypass engine installation over the entire operating Mach number range from 1.10 to 3.20. When approximate bypass plume modeling is included, the supersonic through-flow fan engine configuration shows even larger improvements over the turbine bypass engine configuration. Author

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Scientific and Technical Aerospace Reports

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01 AERONAUTICS (GENERAL)

No abstracts in this category.

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer.*

N90-26790 Georgia Inst. of Tech., Atlanta.
VELOCITY MEASUREMENTS ON A LIFTING ROTOR/AIRFRAME CONFIGURATION IN LOW SPEED FORWARD FLIGHT Ph.D. Thesis
Shiuh-Guang Liou 1988 217 p
Avail: Univ. Microfilms Order No. DA8916161

Aerodynamic interactions between rotorcraft components and the rotor wake are extremely complex. Existing theories or analytical models are inadequate to treat these problems properly and give satisfactory results. The main reasons for this are inadequate detailed physical insights into these complicated phenomena and the lack of a database for validation of new codes. Experiments in these areas are, therefore, important for providing the substantial information that is missing. The interactions between a rotor and an airframe are studied, emphasizing what happens as the vortex filaments from the rotor blade approach the airframe. Periodic and time-averaged velocities were measured using a laser velocimeter in planes parallel to and both above and below the rotor tip path plane. Velocity variations along horizontal lines above the airframe and measurements during vortex impingement were also obtained. Strong vortex interaction effects were observed in the wake flowfield, and the wake is also altered by the presence of the airframe. In order to provide more detailed understanding on the vortex-surface interaction phenomenon, a complete measurement program focused on the area on the surface where vortex impingement occurs was, therefore, performed.

Dissert. Abstr.

N90-26791 Oklahoma Univ., Norman.
SUBSTITUTION PRINCIPLE THEORY FOR COMPRESSIBLE FLOWS Ph.D. Thesis
Jose Luis Rodriguez-Azara 1988 108 p
Avail: Univ. Microfilms Order No. DA8915495

The substitution principle is a transformation of the dependent variables that leaves invariant the steady Euler equation. It was discovered by Munk and Prim (1947), and later by Yih (1960). More recently, Rodriguez Azara and Emanuel (1988 and 1989) have applied it to compressible flows. The transformation was studied, including all possible forms and invariance (Rodriguez Azara and Emanuel 1989). Following Prim (1952), the canonical equations are introduced and weak and strong rotational flows are discussed. From a thermodynamic analysis, the fundamental equation in the enthalpy representation (Emanuel 1987) is obtained. This equation is based on the most general equation of state (Prim 1952) compatible with the substitution principle. In the process, it was concluded that a perfect gas is the only useful assumption consistent with the principle for compressible flow. The vorticity is discussed under the substitution principle, including a new transformation theorem and a relation for the vorticity is provided following a fluid particle. The substitution principle is used to obtain a set of exact rotational solutions to the steady Euler equations. These solutions include: parallel flow, flow across an oblique shock, Prandtl-Meyer flow, and Taylor-Maccoll flow. The analysis includes vorticity calculations for the shock and Prandtl-Meyer flows. The possibility of generating curved shock waves with zero vorticity behind them is discussed. Rotational hodograph equations are developed for a compressible two-dimensional or axisymmetric flow. In constrast to the usual hodograph equations, these are nonlinear. By use of the substitution principle, it is shown how to obtain solutions to the nonlinear two-dimensional equations from known irrotational solutions. A rotational source flow is used as an example of an exact solution to the nonlinear equations.

Dissert. Abstr.

N90-26792# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France). Fluid Dynamics Panel.
EXPERIMENTAL TECHNIQUES IN THE FIELD OF LOW DENSITY AERODYNAMICS
Jean Allegre, Michel Raffin, and J. J. Bernard, ed. (Paris VI Univ., France) Apr. 1990 87 p In FRENCH Original contains color illustrations
(AGARD-AG-318(Fr); ISBN-92-835-2115-3) Copyright Avail: NTIS HC A05/MF A01; Non-NATO Nationals requests available only from AGARD/Scientific Publications Executive

Over the last decade, the development of space programs created some experimental research which has resulted in a better understanding of the character and properties of rarefied gas flow dynamics. Some measurement techniques are examined which are most commonly used in a low density wind tunnel or in the case of altitude simulation. The measurements are designed for subsonic, supersonic, and hypersonic flow at low Reynolds number, and are related to the conditions of reentry flight. The instrumentation used in the average test of low density differs fundamentally from the usual instrumentation of wind tunnel in the ratio of the rarefaction of flow, which limits the amplitude of large measurements (forces, pressure, mass volume) and changes the conditions of viscosity and flow interaction. The rarefaction of the drawn flow generally thickens the boundary layer and alters the shock wave structure. After a short description of the experimental techniques, some discussion is presented of their limits along with certain measurement results from the low density flow.

Transl. by E.R.

N90-26793# Aeronautical Research Labs., Melbourne (Australia).
ARLSUPER VERSION 1.0, PROGRAM USERS GUIDE
I. H. Grundy Apr. 1990 33 p
(AD-A222693; ARL-STRUC-TM-526; DODA-AR-006-090) Avail: NTIS HC A03/MF A01 CSCL 20/4

The computer program ARLSUPER calculates linearized steady and oscillatory supersonic flow around a coplanar wing and tail, vertical fin configuration using an explicit finite difference scheme. In this version, surface and mode shapes may be entered in

functional form or as a collection of data points. Generalized forces are calculated and are written out in a form compatible with available flutter solvers. GRA

N90-26794# Stanford Univ., CA. Dept. of Aeronautics and Astronautics.
PARTICLE SIMULATION OF HYPERSONIC FLOW Final Report, 1 Apr. 1988 - 31 Mar. 1990
Donald Baganoff 24 Apr. 1990 75 p
(Grant AF-AFOSR-0139-88; AF Proj. 2307)
(AD-A222704; AFOSR-90-0555TR) Avail: NTIS HC A04/MF A01 CSCL 20/4

A limitation of the DSMC method is that it does not allow efficient use of vector architectures that are predominate in current supercomputers. A new selection rule for collisions between simulated molecules is developed which is highly compatible with vectorization. The collision-selection rule is shown to give identical results to the DSMC method in predicting shock-wave structure and in predicting the correct mean-free path variation with density and temperature for power-law interactions ranging from hard sphere to Maxwell molecule. Algorithmic improvements beyond those related to vectorization issues alone are also introduced, making possible simulations of single-species, rarefied, 3-D hypersonic flows employing 10 million particles and 0.5 million cells. The performance of the algorithm on the Cray-2 ranges from 1 to 2 microseconds/particle/time-step. Roughly 500 to 1000 time-steps are needed to time average the results of a simulation, leading to run times of 2 to 5 hours on the Cray-2 for large problems. GRA

N90-26795# Brown Univ., Providence, RI. Div. of Applied Mathematics.
COMPUTATIONAL METHODS FOR PROBLEMS IN AERODYNAMICS USING PARALLEL AND VECTOR ARCHITECTURE Final Report, Sep. 1985 - Feb. 1990
David Gottlieb 25 Apr. 1990 16 p
(Grant AF-AFOSR-0303-85; AF Proj. 2304)
(AD-A221979; AFOSR-90-0564TR) Avail: NTIS HC A03/MF A01 CSCL 20/4

The objective of our research was to design a computer code capable of simulating interactions between complicated flows and shock waves. It is possible to completely overcome the Gibbs phenomenon from the approximation (or signal processing) point of view. The main theoretical breakthrough has been the observation that the Gibbs phenomenon does not apply to moments of the approximated function. These moments are obtained with high accuracy. The only remaining difficulty is the accurate reconstruction of a given function from its moments. We have suggested and tested several different methods. Computationally the above ideas are carried out as low-pass filters. We have proved that when a discontinuous signal is being evolved in time by a linear system of hyperbolic equations, the moments are obtained with spectral accuracy. An essentially non-oscillatory spectral method is developed for the numerical simulations of non-linear equations. Cell Averages techniques are developed for Fourier and Chebyshev Spectral methods. This techniques is crucial for modern shock capturing techniques. GRA

N90-26796# Naval Research Lab., Washington, DC. Center of Fluid Dynamics Development Branch.
EXPERIMENTS WITH UNSTEADY, FREE SURFACE, THREE-DIMENSIONAL VORTICES IN A THERMALLY STABLE, STRATIFIED FLUID
M. B. Stewart, S. B. Cohen, and A. W. Troesch (Michigan Univ., Ann Arbor.) 14 May 1990 31 p Sponsored by ONR, Arlington, VA
(AD-A222088; NRL-MR-6630) Avail: NTIS HC A03/MF A01 CSCL 01/1

The unsteady characteristics of a vortex pair formed behind a delta wing airfoil at a negative angle of attack have been studied experimentally in a large towing tank with a stable density stratification. Measurements of the vortex pair's upward migration and visualizations of the vortex circulation were made using the hydrogen bubble technique with a laser sheet illumination in the transverse plane. Axial visualizations of the vortex migration and axial velocities at the vortex core were made using the hydrogen bubble technique with a diffuse light source. The effects of the rising vortices and their circulation on the free surface temperature field was recorded using an imaging infrared radiometer mounted over the free surface. GRA

N90-26797# Naval Postgraduate School, Monterey, CA. Dept. of Aeronautics and Astronautics.
FLOW VISUALIZATION OF DYNAMIC STALL ON AN OSCILLATING AIRFOIL M.S. Thesis
Bruce E. Brydges Sep. 1989 116 p
(AD-A222202) Avail: NTIS HC A06/MF A01 CSCL 01/1

Stroboscopic schlieren photography was used to investigate the effects of compressibility, reduced frequency, and amplitude on the dynamic stall of a NACA 0012 airfoil subjected to sinusoidal oscillation. The Mach number was varied from M at infinity = 0.25 to M at infinity = 0.45 (corresponding to a Reynolds number variation of Re = 450,000 to Re = 810,000); the reduced frequency was varied from k = 0.025 to k = 0.10. Oscillation amplitudes of alpha sub m = 5 deg and alpha sub m = 10 deg were compared. Schlieren photographs are presented, which document the dynamic stall vortex formation, convection, and shedding sequence for various experimental conditions. Additionally, a preliminary examination of the flow reattachment process was conducted. Data derived from the photographs indicates that increasing the compressibility causes dynamic stall to occur at lower angles of attack, while increasing the reduced frequency and/or the oscillation amplitude effectively delays dynamic stall effects to a higher angle of attack. Flow reattachment is sensitive to both Mach number and reduced frequency for low values of these parameters; when either the Mach number or reduced frequency is sufficiently high, the reattachment process stabilizes. GRA

N90-26798# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Engineering Science and Mechanics.
AERODYNAMIC/DYNAMIC INTERACTION Final Report, 1985 - 1989
Dean T. Mook and Ali H. Nayfeh 13 Apr. 1990 16 p
(Grant AF-AFOSR-0158-85; AF Proj. 2307)
(AD-A222263; AFOSR-90-0554TR) Avail: NTIS HC A03/MF A01 CSCL 01/1

A numerical/analytical development of simulations of the interactions among aerodynamics, dynamics and control systems was performed. A new unsteady vorticity panel method, a new analytical model of wing rock, and new simulations of the responses of vehicle to control surface motions were developed. GRA

N90-26799# Army Aviation Systems Command, Moffett Field, CA. Aeroflightdynamics Directorate.
OBTAINING CONSISTENT MODELS OF HELICOPTER FLIGHT-DATA MEASUREMENT ERRORS USING KINEMATIC-COMPATIBILITY AND STATE-RECONSTRUCTION METHODS
Jay W. Fletcher May 1990 12 p Presented at the 46th Annual Forum of the American Helicopter Society, Washington, DC, May 1990
(AD-A222533) Avail: NTIS HC A03/MF A01

A new method was developed for application of Kalman Filter/Smoothers to post-flight processing of helicopter flight test dynamic measurements. This processing includes checking for kinematic compatibility among the measurements, identification of a measurement error model, and reconstruction of both measured and unmeasured time histories. Emphasis is placed on identification of a parametric measurement error model which is valid for a set of flight test data. This is facilitated through a new method of concatenating several maneuver time histories. The method also includes a model structure determination step which ensures that a physically realistic parameterization has been achieved. Application of the method to a set of BO-105 flight test data is illustrated. The resulting minimally parameterized error model is shown to characterize the measurement errors of the entire data

set with very little variation in the parameter values. Reconstructed time histories are shown to have increased bandwidths and signal to noise ratios. GRA

N90-26800*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.
ROTORCRAFT AEROMECHANICAL STABILITY-METHODOLOGY ASSESSMENT. PHASE 2: WORKSHOP
William G. Bousman Mar. 1990 270 p Prepared in cooperation with Army Aviation Systems Command, Moffett Field, CA
(NASA-TM-102272; NAS 1.15:102272; AD-A222543; NASA-992-21-01-Phase-2; USAAVSCOM-TR-90-A-001-Phase-2) Avail: NTIS HC A12/MF A02 CSCL 01/1

Helicopter rotor aeroelastic and aeromechanical stability predictions for four data sets were made using industry and government stability analyses and compared with data at a workshop held at Ames Research Center, August 2-3, 1988. The present report contains the workshop comparisons. GRA

N90-26801# David Taylor Research Center, Bethesda, MD. Dept. of Ship Hydromechanics.
INSTALLATION AND PRETEST ANALYSIS OF DARPA SUBOFF MODEL IN THE DTRC ANECHOIC WIND TUNNEL Departmental Report
Han-Lieh Liu, Chen-Wen Jiang, David J. Fry, and Ming S. Chang Mar. 1990 58 p
(AD-A221497; DTRC/SHD-1298-04) Avail: NTIS HC A04/MF A01 CSCL 12/5

Detailed flow measurements around an axisymmetric body were required in the wind tunnel as a part of the SUBOFF Program. To ensure the quality of all experimental data, potential flow and boundary layer computer programs were used to determine the effects of tunnel blockage, the supporting struts, the open jet, and the procedure to align the model with the flow in the wind tunnel. The results of these pre-test analyses were then used to guide the experimental setup and tunnel reference velocity selection. Pre-test analyses indicated that the velocity distribution in the x/L=0.85 plane was quite uniform. It is recommended that this plane should be used as the tunnel reference plane to normalize all predicted and measured velocities and pressures. The majority of tunnel blockage effect is estimated by using these references. The most sensitive locations for the surface pressure measurements were at the pressure taps at x/L=0.04 and 0.78. The pressure variations at these locations were used to align the model with the flow in the wind tunnel. GRA

03 AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation.*

No abstracts in this category.

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Space Communications, Spacecraft Communications, Command and Tracking* and *Communications and Radar.*

N90-26802# Federal Aviation Administration, Atlantic City, NJ.
DALLAS/FORT WORTH SIMULATION, VOLUME 1
Lloyd Hitchock, Lee E. Paul, Ephraim Shochet, and Richard D. Algeo Nov. 1989 124 p
(Contract F2006C)
(DOT/FAA/CT-TN89/28-Vol-1) Avail: NTIS HC A06/MF A01

A series of dynamic, real-time, air traffic control simulations of selected aspects of the Dallas/Fort Worth (D/FW) Metroplex Air Traffic System Plan was conducted. Using D/FW controllers as subjects, the simulations provided an opportunity to evaluate proposed changes in area flow patterns and traffic management and to experience simultaneous approaches to the four parallel runway configuration under consideration for D/FW. A detailed description of the objectives of the study and of the technical approach and test methods used, are given. In addition, the combined results of the study and conclusions are presented. Author

N90-26803# Federal Aviation Administration, Atlantic City, NJ.
DATA LINK TEST AND ANALYSIS SYSTEM/ATCRBS TRANSPONDER TEST SYSTEM TECHNICAL REFERENCE
John VanDongen May 1990 159 p
(Contract FAA-T2001-F)
(DOT/FAA/CT-TN90/7) Avail: NTIS HC A08/MF A01

Reference material for persons using the Data Link Test and Analysis System (DATAS) for testing Air Traffic Control Radar Beacon System (ATCRBS) transponders is provided. Included is a brief overall description of the DATAS, a brief description of the ATCRBS, a thorough description of how to operate the DATAS ATCRBS transponder analysis system (User Guide), a detailed description of the DATAS ATCRBS transponder analysis programs, and a thorough description of each of the transponder field tests. Author

N90-26804*# Illinois Univ., Urbana-Champaign. Dept. of Psychology.
COGNITIVE REQUIREMENTS FOR AIRCRAFT NAVIGATION Ph.D. Thesis
Anthony J. Aretz Mar. 1990 124 p Sponsored in part by AFIT, Wright-Patterson AFB, OH
(Grant NAG2-308)
(NASA-CR-186933; NAS 1.26:186933; AD-A222736; AD-E501239; AFIT/CI/CIA-90-011D) Avail: NTIS HC A06/MF A01 CSCL 17/7

A cognitive analysis of a pilot's navigation task is presented, and using this foundation, an experiment is described comparing a new map display, employing the principal of visual momentum, to the two traditional track-up and north-up approaches. The visual momentum display is based on the characterization of the pilot's navigation task as the maintenance of a cognitive link between two reference frames (RFs) -- the ego-centered reference frame (ERF) an the world-centered reference frame (WRF). The ERF corresponds to the pilot's forward view of the world and the WRF corresponds to a north-up geographic map. The new map display employs visual momentum by presenting the ERF, in the form of a perceptual wedge, in the context of a north-up map's WRF. An experiment was conducted to assess the different displays using licensed pilots to perform diverse navigation tasks in the context of computer simulated helicopter missions. As predicted, the data showed the advantage to a track-up map is its congruence with the ERF; however, the development of survey knowledge is hindered by the inconsistency of the rotating display. GRA

N90-26805# Transportation Systems Center, Cambridge, MA.
FAA LORAN EARLY IMPLEMENTATION PROJECT Final Report, Oct. 1984 - Sep. 1989
Ian G. McWilliams, Francis J. Coyne, Stephen F. Nuzzi, and Franklin D. MacKenzie Mar. 1990 174 p
(AD-A221866; DOT-TSC-FAA-90-1; DOT/FAA/SA-90/4) Avail: NTIS HC A08/MF A01 CSCL 17/7

The Early Implementation Project (EIP), was the initial step in the process of Loran integration into the National Airspace System (NAS). The EIP was designed to give the FAA and the Loran user community experience in the operational use of Loran. The success of the entire Loran aviation program, particularly the EIP, depended upon the active participation of many organizations inside and outside the FAA. The experience gained in the EIP has helped the FAA make the transition from the limited project to the fully operational system at airports around the country and general users operating with TSO standard receivers. The EIP also serves as a model for the introduction of the Global Positioning System (GPS) into the NAS during the 1990s. GRA

N90-26806# Technische Univ., Brunswick (Germany, F.R.). Inst. fuer Verkehr, Eisenbahnwesen und Verkehrssicherung.
INVESTIGATIONS OF MONOPULSE-ASSISTED RADIO LOCATION SYSTEMS FOR THE SAFETY OF SURFACE TRAFFIC [UNTERSUCHUNGEN VON MONOPULSGESTUETZTEN FUNKORTUNGSSYSTEMEN ZUR SICHERUNG DES ROLLVERKEHRS]
Wolfgang Detlefsen Nov. 1989 41 p In GERMAN
(ETN-90-97324) Avail: NTIS HC A03/MF A01

A radio location system for airport surface traffic, based on the mode S squitter is presented. The address-selective mode S allows positioning with identification as well as bidirectional data transmission between ground station and aircraft. The expected accuracy is between 10 and 20 m. Transponder and data link are standardized for the mode S. The location can be performed with a small number of sensors using time of flight difference measurements. The basis of the location system is the squitter sent every second by the transponder. Tests with an experimental sensor in a strongly perturbed environment show that time of flight difference measurements and angle measurements can be performed using the amplitude monopulse technique. The requirements for the signal processing are very high. ESA

N90-27446# Air Force Systems Command, Norton AFB, CA.
GLOBAL POSITIONING SYSTEM OVERVIEW/STATUS
M. T. Runkle and B. Siegel (Aerospace Corp., Los Angeles, CA.) *In* AGARD, Tactical Applications of Space Systems May 1990 7 p (For primary document see N90-27438 21-66)
Copyright Avail: NTIS HC A07/MF A01; Non-NATO Nationals requests available only from AGARD/Scientific Publications Executive

N90-27447# Air Force Systems Command, Eglin AFB, FL. Munitions Systems Div.
FUTURE APPLICATIONS OF GPS TO CONVENTIONAL WEAPONS
Stephen M. McElroy and Louis R. Cerrato *In* AGARD, Tactical Applications of Space Systems May 1990 13 p (For primary document see N90-27438 21-66)
Copyright Avail: NTIS HC A07/MF A01; Non-NATO Nationals requests available only from AGARD/Scientific Publications Executive

N90-27449# Aerospace Corp., Los Angeles, CA.
POTENTIAL NEW TACTICAL APPLICATIONS OF THE GLOBAL POSITIONING SYSTEM (GPS)
Mohan P. Ananda and John E. Clark *In* AGARD, Tactical Applications of Space Systems May 1990 9 p (For primary document see N90-27438 21-66)
Copyright Avail: NTIS HC A07/MF A01; Non-NATO Nationals requests available only from AGARD/Scientific Publications Executive

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics*.For land transportation vehicles see *85 Urban Technology and Transportation*.

N90-26807# Air Force Wright Aeronautical Labs., Langley AFB, VA. Materials Lab.
PROCEEDINGS OF THE 1987 AIRCRAFT/ENGINE STRUCTURAL INTEGRITY PROGRAM (ASIP/ENSIP) CONFERENCE Final Report, Dec. 1987 - Mar. 1988
John W. Lincoln and Thomas D. Cooper Jun. 1988 914 p Conference held in San Antonio, TX, 1-3 Dec. 1987
(AF Proj. 2418)
(AD-A198037; AFWAL-TR-88-4128) Avail: NTIS HC A99/MF E06 CSCL 01/2

Topics addressed include: composite structures; metallic structures; mechanical subsystems integrity program (MECSIP)/ engine structural integrity program (ENSIP); materials/tracking; HSIP/analysis/methods; and instruments/tracking. For individual titles, see N90-26808 through N90-26822.

N90-26808# Northrop Corp., Hawthorne, CA.
LESSONS LEARNED FOR COMPOSITE AIRCRAFT STRUCTURES QUALIFICATION
In AFWAL, Proceedings of the 1987 Aircraft/Engine Structural Integrity Program (ASIP/ENSIP) Conference Jun. 1988 p 9-43 (For primary document see N90-26807 21-05)
Avail: NTIS HC A99/MF E06 CSCL 01B

An overview of the extensive experience, lessons learned, and recommended certification procedures from two major USAF composite research and development programs is presented. Subject areas discussed in detail are static strength, fatigue/ durability, and damage tolerance. Author

N90-26809# Grumman Aerospace Corp., Bethpage, NY. Aircraft Systems Div.
DEVELOPMENT OF A GRAPHITE/BISMALEIMIDE LEADING EDGE FOR THE F-111 (EF-111A) HORIZONTAL STABILIZER
J. A. Suarez, S. C. Nolet, and M. Carteaux (Air Force Wright Aeronautical Labs., Wright-Patterson AFB, OH.) *In* AFWAL, Proceedings of the 1987 Aircraft/Engine Structural Integrity Program (ASIP/ENSIP) Conference Jun. 1988 p 44-52 (For primary document see N90-26807 21-05)
Avail: NTIS HC A99/MF E06 CSCL 01B

The F-111 (EF-111A) horizontal stabilizer leading edge was selected as the baseline component to demonstrate the superior supportability characteristics of composites. The production component is a full-depth aluminum honeycomb sandwich construction that has historically shown in-service supportability programs. The composite leading edge (22.4 sq ft in plan area) was designed as a form, fit and function replacement for the existing aircraft. Because of the aircraft's leading edge high service temperature (317 F) and humidity environment (83 percent relative humidity), skins and stiffening members were designed of graphite/bismaleimide (Gr/BMI). At equivalent weight, acquisition and life cycle cost savings of 13 and 45 percent respectively were projected, for the composite leading edge over the existing aluminum honeycomb sandwich assembly. Author

N90-26810# McDonnell-Douglas Corp., Saint Louis, MO. Structural Research Dept.
AN EXPERT SYSTEM ADVISOR FOR DAMAGE REPAIR OF COMPOSITE WING SKINS (REPAIRMAN)
Herb Smith, Jr., Charles Saff, and Tom Christian (Warner Robins Air Logistics Center, Robins AFB, GA.) *In* AFWAL, Proceedings of the 1987 Aircraft/Engine Structural Integrity Program (ASIP/ENSIP) Conference Jun. 1988 p 53-61 (For primary

document see N90-26807 21-05)
Avail: NTIS HC A99/MF E06 CSCL 01B

Temporary repair of battle-damaged composite wing skins is addressed by an expert system advisor that produces a bolted patch design suitable for the next mission requirements of the aircraft. The repair methodology utilized was developed under Air Force contract and addresses the temporary repair of damage holes up to seven inches in diameter using bolted patches of aluminum or steel sheets. The patch materials are available in the standard aircraft repair kit. Author

N90-26811# Air Force Wright Aeronautical Labs., Wright-Patterson AFB, OH. Nondestructive Evaluation Branch.
CHARACTERIZATION OF IMPACT DAMAGE IN COMPOSITES **c24**
C. F. Buynak and T. J. Moran *In* AFWAL, Proceedings of the 1987 Aircraft/Engine Structural Integrity Program (ASIP/ENSIP) Conference Jun. 1988 p 133-152 (For primary document see N90-26807 21-05)
Avail: NTIS HC A99/MF E06 CSCL 11D

Some of the most critical flaws encountered during the service life of a composite component results from impact damage due to foreign objects (FOD). The seriousness of this problem has led to much work in both the nondestructive evaluation and mechanics communities to characterize and assess the effects of such damage. A new ultrasonic method which nondestructively produces and displays images of the damage on a ply-by-ply basis with all of the data being collected during a single scan, is presented. Specimens consisting of 32 ply quasi-isotropic graphite/epoxy and graphite/PEEK composites were examined. Selected data from a specimen of each material that was subjected to a 20 J (15 ft-lb) impact will be presented to demonstrate the power of this new technique. Author

N90-26812# Air Force Systems Command, Wright-Patterson AFB, OH. Aeronautical Systems Div.
LESSONS LEARNED FROM THE T-46A DURABILITY AND DAMAGE TOLERANCE PROGRAM
Hsing C. Yeh *In* AFWAL, Proceedings of the 1987 Aircraft/Engine Structural Integrity Program (ASIP/ENSIP) Conference Jun. 1988 p 280-310 (For primary document see N90-26807 21-05)
Avail: NTIS HC A99/MF E06 CSCL 11D

The T-46A durability and damage tolerance program accomplishments through full scale engineering development are presented. The T-46A design criteria, analysis, development test, and the full scale durability test are discussed. A detail discussion of the findings of the pre-production design verification (PDV) tests, full scale durability test and proposed design changes to be incorporated in the production articles are described. Special manufacturing processes such as application of cold work, installation of interference fasteners are also presented. Lessons learned from the program are discussed in detail. It is believed that use of the lessons learned will significantly reduce durability and damage tolerance technical risk, for future structural integrity programs. Author

N90-26813# Pratt and Whitney Aircraft, West Palm Beach, FL. Advanced Engineering Operations.
RETIREMENT FOR CAUSE OF THE F100 ENGINE
John A. Harris, Jr. and M. C. VanWanderham *In* AFWAL, Proceedings of the 1987 Aircraft/Engine Structural Integrity Program (ASIP/ENSIP) Conference Jun. 1988 p 515-529 (For primary document see N90-26807 21-05)
Avail: NTIS HC A99/MF E06 CSCL 11D

Retirement for cause (RFC) is a life cycle management procedure for gas turbine engine components, such as fan, compressor and turbine disks. The procedure enables full use of the safe life inherent in each component, as opposed to arbitrary retirement from service of all components at a calculated low cycle fatigue life. Historically, these components have been retired at the accumulated time (or cycles) where the first fatigue craft in 1000 identical components, all used in an identical manner, could be expected to occur. By definition then, 99.9 percent of these components were being retired prematurely, while they still may have had useful life remaining. The retirement for cause approach is based on fracture mechanics and nondestructive evaluation, and is evaluated economically. The U.S. Air Force recognized the potential of this approach for maintenance life cycle cost savings and began development programs in the late 1970s and early 1980s to reduce the RFC concept to practice. Those programs have been successfully completed. The development and integration of the methodology, its implementation for 23 USAF F100 engine components by the San Antonio Air Logistics Center, and its economic and other benefits are discussed. Author

N90-26814# Systems Research Labs., Inc., Dayton, OH. NDE Systems Div.
A GENERAL DISCUSSION OF THE RETIREMENT FOR CAUSE INSPECTION SYSTEM **c07**
Wally C. Hoppe *In* AFWAL, Proceedings of the 1987 Aircraft/Engine Structural Integrity Program (ASIP/ENSIP) Conference Jun. 1988 p 530-542 (For primary document see N90-26807 21-05)
(Contract F33615-81-C-5002)
Avail: NTIS HC A99/MF E06 CSCL 11D

The retirement for cause (RFC) system was developed to inspect the F100 engine at the engine overhaul facility of Kelly AFB, San Antonio, TX. This completely automated system, which utilizes both eddy current and ultrasonic inspection technologies, has been thoroughly tested before implementation at Kelly AFB. As of September 1, 1987, after ten and one half months in production, the system has inspected approximately 1900 parts. An overview of the RFC system and a presentation of the results of the reliability tests will be given. Some of the highlights of the inspection techniques and algorithms will also be outlined, in order to show how this automated, computer controlled system can achieve the reliable and sensitive inspections that were demonstrated. Author

N90-26815# Lockheed-Georgia Co., Marietta.
COMPUTERIZED CORROSION FORECASTING MODEL FOR C-5 AIRCRAFT
Robert N. Miller and Fred H. Meyer (Air Force Wright Aeronautical Labs., Wright-Patterson AFB, OH.) *In* AFWAL, Proceedings of the 1987 Aircraft/Engine Structural Integrity Program (ASIP/ENSIP) Conference Jun. 1988 p 543-564 (For primary document see N90-26807 21-05)
(Contract F33615-85-C-5058)
Avail: NTIS HC A99/MF E06 CSCL 11D

A predictive corrosion model which will enable optimum corrosion maintenance scheduling for C-5 aircraft is being developed. The VAX-2 computer program is based on the kinetics of corrosion of aircraft alloys and upon the environmental conditions existing at Air Force bases. When completed, it will provide a fully integrated method for predicting crack growth, corrosion damage, and coating degradation for C-5 aircraft operating in a variety of environments. The corrosion model is being validated by comparing predicted crack lengths with actual crack lengths in the test article used in the C-5A modified wing structural test evaluation and by comparing predicted corrosion damage with corrosion control man-hours expended on selected areas of the C-5B aircraft. In the cracks analyzed to date, the predicted crack lengths are very close to the actual lengths. With only minor modification, the predictive corrosion modeling program may be used for the C-141, C-130, B-52 or any other aircraft fleet which already has a crack monitoring program in operation. Author

N90-26816# Aluminum Co. of America, Davenport, IA.
AN ALUMINUM QUALITY BREAKTHROUGH FOR AIRCRAFT STRUCTURAL RELIABILITY
C. R. Owen, R. J. Bucci (Aluminum Co. of America, Alcoa Center, PA.), and R. J. Kegarise *In* AFWAL, Proceedings of the 1987 Aircraft/Engine Structural Integrity Program (ASIP/ENSIP) Conference Jun. 1988 p 565-591 (For primary document see

N90-26807 21-05)
Avail: NTIS HC A99/MF E06 CSCL 11D

In 1983 Alcoa's Davenport Works initiated a statistically design experiment to evaluate effects of metal processing on thick plate metal quality. An outgrowth of this program has been a breakthrough in quality and resultant property improvements that can be exploited for fatigue and fracture critical structures. The statistical quality control effort is described and evidence is given the improved capabilities typical of recently produced high quality material. Among conventional mechanical property tests, the smooth fatigue test is shown to be the most discriminating for initial metal quality. Data are shown correlating longer lifetimes to reduced microporosity size in the improved plate. Replicate fatigue tests enable definition of a characteristic initial flow size distribution which can serve as a starting point for flaw growth analysis and life management. These findings are discussed relative to initial fatigue quality guarantees and compatibility with emerging U.S. Air Force durability analysis methodology. In summary, it is shown that the combination of more discriminating testing and a superior product offers considerable promise for reliability improvement in aircraft structural designs of the future. Author

N90-26817# Sikorsky Aircraft, Stratford, CT.
APPLICATION OF DAMAGE TOLERANCE
George J. Schneider *In* AFWAL, Proceedings of the 1987 Aircraft/Engine Structural Integrity Program (ASIP/ENSIP) Conference Jun. 1988 p 593-614 (For primary document see N90-26807 21-05)
Avail: NTIS HC A99/MF E06 CSCL 01C

Sikorsky Aircraft has been under contract since late 1982 to investigate the application of damage tolerance to the H-53 helicopter. This program has involved identification of critical structure, usage spectrum evaluation, loads evaluation, detail stress analyses, material and verification testing, and development of stress intensity solutions. The primary objectives of the program were to develop a computer program for use by Sikorsky and Warner Robins-ALC to perform crack growth analysis of helicopter structure, to evaluate crack growth in a select group of rotor and airframe structure, and to access the feasibility of damage tolerance force management for the H-53 Air Force fleet. A presentation was made at the 1984 Aircraft Subsystems Integrity Program (ASIP) conference to provide an introduction to this program. Since then Sikorsky has completed an initial crack propagation analysis of a select group of rotor and airframe structure. The purpose of this presentation is to review some of the technical issues involved in the crack growth analysis, to present some of the analysis results, and to review conclusions and lessons learned. Author

N90-26818# Sikorsky Aircraft, Stratford, CT. Diagnostics.
INDIVIDUAL HELICOPTER TRACKING PROGRAM (IHTP) FOR THE MH-53J HELICOPTER
John G. B. Daniell *In* AFWAL, Proceedings of the 1987 Aircraft/Engine Structureal Integrity Program (ASIP/ENSIP) Conference Jun. 1988 p 615-639 (For primary document see N90-26807 21-05)
Avail: NTIS HC A99/MF E06 CSCL 01C

The cost and complexity of maintaining aircraft in the Air Force inventory escalates with time. New methods are required to increase the cost effectiveness of fleet aircraft maintenance while simultaneously decreasing down time and improving readiness rates. A system is being developed which can collect details of usage of each helicopter in the fleet automatically. The resulting data base can then be used in conjunction with analytical processes to determine component inspection intervals using Damage Tolerance Assessment (DTA) techniques. This will replace the present assumption of one universal usage spectrum for all, regardless of the actual usage of individual aircraft. The helicopter peculiar aspects of component life estimation and the present methodology will be reviewed. The new system will be described and the process involved will be outlined. Author

N90-26819# PhotoStrain, Dallas, TX.
PHOTOELASTICITY: A COST EFFECTIVE DESIGN TOOL c39
Jan Cernosek *In* AFWAL, Proceedings of the 1987 Aircraft/Engine Structural Integrity Program (ASIP/ENSIP) Conference Jun. 1988 p 640-646 (For primary document see N90-26807 21-05)
Avail: NTIS HC A99/MF E06 CSCL 20C

The great error of the past years was labeling a finite element (FE) method and three-dimensional photoelasticity as being two competing methods. Where finite element method works exceptionally well (thin walled airframe structures, for example), photoelasticity is nearly helpless but it excells in the area where FE has to use solid modeling which is time consuming, expensive and of questionable accuracy. Photoelasticity and finite element method should be considered to be complementary rather than competing methods of stress. Author

N90-26820# Air Force Wright Aeronautical Labs., Wright-Patterson AFB, OH.
FINITE ELEMENT MODELS OF USAF AIRCRAFT STRUCTURES
James J. Olsen and Vipperla B. Venkayya *In* AFWAL, Proceedings of the 1987 Aircraft/Engine Structural Integrity Program (ASIP/ENSIP) Conference Jun. 1988 p 655-671 (For primary document see N90-26807 21-05)
Avail: NTIS HC A99/MF E06 CSCL 01C

Finite element analysis is at present an industry standard for the analysis and design of aerospace structures. Significant resources are expected to be allocated for developing, testing and validating finite element models (FEMS) of current and the future USAF aircraft. The premise is that the effective use of finite element analysis can reduce (not eliminate) dependence on test procedures which are very costly both in time and resources. However, there is a lot to be desired from the way industry and Government organize and perform finite element analysis. The major deficiency is the lack of a clear definition of the analysis objectives and tailoring the models to achieve the goals in a most economical and reliable way. An even more disturbing fact is that, at present, industry developed finite element models are a wasted effort as far as future utility is concerned, because the Air Force does not take delivery of these models in an organized, predictable way. Hence, various potential users of FEMS throughout USAF do not know if and where the FEMS exist and how to gain access and use them. The result can be a duplication of developments and an unnecessary cost to the USAF. Various cost-effective ways of taking delivery of finite element model data and establishing procedures for archiving, communicating, retrieving and validating in a secure environment are explored. It also delineates the cost and performance benefits that can be derived during the life of an aircraft by maintaining an accurate and readily available library of finite element models of USAF aircraft. Author

N90-26821# Southwest Research Inst., San Antonio, TX.
AUTOMATED ANALYSIS OF MXU-553 FLIGHT DATA
Kurt H. Schrader *In* AFWAL, Proceedings of the 1987 Aircraft/Engine Structural Integrity Program (ASIP/ENSIP) Conference Jun. 1988 p 793-818 (For primary document see N90-26807 21-05)
Avail: NTIS HC A99/MF E06 CSCL 01C

As part of the aircraft structural integrity program developed by the U.S. Air Force, different types of aircraft have been involved in a flight data recording program for many years. Software for analyzing the data recorded by the MXU-553 equipped aircraft, for generating spectra and profile information, and to display the resulting data were developed. This software was designed to process not only the MXU-553 data but also the data from the micro-processor recorders being developed at this time. Once all software had been written, a final requirement of the contract with the Air Force was to process many hours of MXU-553 data and report the results. The programs developed for San Antonio Air Logistics Center (SA-ALC/MMSA) are summarized in the interaction overview. The first program consists of a compression effort where the raw MXU-553 data is converted to engineering units and compressed to retain only significant flight data. This compressed flight data is processed by SA-ALC using the

edit/pre-analysis program which allows for tabular and graphic display of data and editing of erroneous information. The final program permits the tabulation of spectra and profile information and is named SOUP (Spectra and Operational Usage Profile). This program is the subject of this presentation. Author

N90-26822# Air Force Wright Aeronautical Labs., Langley AFB, VA.
PEAK IDENTIFICATION TECHNIQUES
In its Proceedings of the 1987 Aircraft/Engine Structural Integrity Program (ASIP/ENSIP) Conference Jun. 1988 p 819-844 (For primary document see N90-26807 21-05)
Avail: NTIS HC A99/MF E06 CSCL 01C

Peak identification is performed, primarily for flight measured data, to reduce the amount of information which must be considered for structural life analyses. The peak identification methodology applied defines those points in time, and therefore limits the measured data, for which further analysis will be performed. Ideally, the peak identification technique used will retain all stress cycles which contribute to structural damage while eliminating those times within an aircraft's life which are unimportant in a structural sense. This peak identification techniques presentation is limited to a discussion of methods by which peak maneuver response times are established. The presentation does not discuss ordering techniques such as range-pair or rain-flow. Additionally, the presentation primarily addresses fighter, attack, and fighter-trainer aircraft. Although examples and discussions are based on these limitations the concepts presented have implications across a broad range of applications. The peak identification techniques presentation concentrates on three established methods of peak identification. These methods are known as Conventional Count or 50 percent Rise-Fall, Range-Pair or Fixed Increment, and Counting Accelerometer or Fixed Return. Author

N90-26823*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
EVALUATION OF ENERGY ABSORPTION OF NEW CONCEPTS OF AIRCRAFT COMPOSITE SUBFLOOR INTERSECTIONS
Lisa E. Jones (PRC Kentron, Inc., Hampton, VA.) and Huey D. Carden Washington Nov. 1989 33 p
(NASA-TP-2951; L-16628; NAS 1.60:2951) Avail: NTIS HC A03/MF A01 CSCL 01C

Forty-one composite aircraft subfloor intersection specimens were tested to determine the effects of geometry and material on the energy absorbing behavior, failure characteristics, and post-crush structural integrity of the specimens. The intersections were constructed of twelve ply + or - 45 sub 6 laminates of either Kevlar 49/934 or AS-4/934 graphite-epoxy in heights of 4, 8, and 12 inches. The geometry of the specimens varied in the designs of the intersection attachment angle. Four different geometries were tested. Author

N90-26824*# Notre Dame Univ., IN. Dept. of Aerospace and Mechanical Engineering.
THE SKY SHARK: AN RPV DESIGNED TO INVESTIGATE THE PRESSURE DISTRIBUTION ON A LIFTING SURFACE Final Design Proposal
Rob Ziemba, Joe Schudt, Karen Comly, Mike Vanthournut, Jerome C. Trybus, Greg Branch, Maggie Hassan, Steve Noll, Steve Julian, and Dave Carey 4 May 1989 176 p
(Contract NASw-4435)
(NASA-CR-186222; NAS 1.26:186222) Avail: NTIS HC A09/MF A01 CSCL 01C

The objective was to design a remotely piloted vehicle which is capable of gathering in-flight pressure distribution data on a lifting test specimen, and then test the design by constructing a subscale demonstrator, to prove the flight worthiness of the concept. The technology demonstrator was scheduled for takeoff at approximately, 7:20 AM on Thursday April 27th. There was a light wind from the southeast. The plane was hand-launched and made an initial dip, most likely due to the poor trim conditions at launch. It then began to climb and bank into a left turn. The aircraft climbed to an altitude of approximately 150 ft and circled. The plane flew for several minutes and at times appeared to bump around, which was due to thermal activity disrupting the flight of the aircraft. The aircraft was brought slowly down in a power-off condition and glided in for a belly landing and landed without incident. Results of the flight test proved the general capability of the design to maintain flight stability throughout the take off, cruise, turning, and landing flight regimes. We were not able to demonstrate stability with the test specimen in place as the control surfaces designed to counteract the instabilities induced in the static system, winglets and ailerons, were not included. Author

N90-26825# Aerospace Medical Research Labs., Wright-Patterson AFB, OH. Biodynamics and Bioengineering Div.
BASEOPS DEFAULT PROFILES FOR CIVIL AIRCRAFT Interim Report, Jul. - Sep. 1989
Robert A. Lee Sep. 1989 94 p
(AF Proj. 7231)
(AD-A223161; AAMRL-TR-90-009) Avail: NTIS HC A05/MF A01 CSCL 12/5

This report describes the default Power Setting/Airspeed/Altitude Profiles for Civil Aircraft takeoffs and landings that are used in the USAF BASEOPS program. BASEOPS is a computerized operations input program for Airbase Noise analyses done under the AF AICUZ program. These takeoff and landing profiles were selected from the FAA Integrated Noise Model (INM) database 9 profiles. The most used stage length for each aircraft was selected to model each takeoff profile. The landing profiles were modeled directly from the INM database. Use of these profiles with the USAF NOISEMAP program should yield similar noise exposure values to the results obtained from the FAA INM program. GRA

N90-26826# McDonnell Aircraft Co., Saint Louis, MO.
DAMAGE TOLERANCE ANALYSIS FOR MANNED HYPERVELOCITY VEHICLES. VOLUME 2: SOFTWARE USER'S MANUAL Final Report, Sep. 1986 - Sep. 1989
D. M. Harmon and C. R. Saff Sep. 1989 164 p
(Contract F33615-86-C-3208; AF Proj. 2401)
(AD-A222136; WRDC-TR-89-3067-Vol-2) Avail: NTIS HC A08/MF A01 CSCL 11/6

The objective was to provide a fracture mechanics based life prediction procedure for hypersonic airframe structures subjected to combined mechanical loadings and thermal profiles. Existing routines were used along with element test data to develop this procedure. Accuracy of the procedure was determined by predicting the crack growth under thermomechanical load histories typical of advanced fighters and aerospace vehicles, and then comparing those predictions with test results. Limitations in the ability of this procedure to predict the test results were used to formulate recommendations for further modeling efforts and research. A fracture mechanics based life prediction procedure was developed for hypersonic airframes subjected to thermomechanical load profiles. The analysis that was developed models crack growth behavior in metals, accounts for the effects of temperature on yield strength and fracture toughness, and includes the effects of sustained loads at elevated temperature on crack growth rate. The analysis was incorporated into a computer routine named DAMAGE. Predictions made with the DAMAGE routine were within 20 percent of the test lives for 67 percent of the combined thermomechanical load history tests performed. GRA

N90-26827# Army Aviation Systems Command, Moffett Field, CA. Aeroflightdynamics Directorate.
MODEL TILT-ROTOR HOVER PERFORMANCE AND SURFACE PRESSURE MEASUREMENT
Chee Tung and Lonnie Branum May 1990 12 p Presented at the 46th Annual Forum of the American Helicopter Society, Washington, DC, May 1990
(AD-A222535) Avail: NTIS HC A03/MF A01 CSCL 01/3

A test of a small scale 3-bladed model rotor, with geometry typical of that used on tilt rotor aircraft, was conducted in the Army Aeroflightdynamics Directorate's anechoic hover chamber.

The purpose was to determine the hover performance of the rotor and investigate the pressure distributions on a blade at various collective pitch angles and tip speeds. The measured pressures indicate that the rotor did not stall for high collective pitch angles up to theta sub c = 25 deg. This is clearly a 3-D effect since 2-D theory predicts flow separation at these high angles. The flow near the trailing edge separated above theta sub c = 25 deg which caused a sharp increase in power. GRA

N90-26828# Dayton Univ., OH. Research Inst.
B-1B IMPROVED WINDSHIELD DEVELOPMENT. VOLUME 2: MAGNA ANALYSIS: BASELINE AND PARAMETRIC Interim Report, Jun. 1987 - Sep. 1988
Michael P. Bouchard and William Braisted Feb. 1990 145 p
(Contract F33615-84-C-3404; AF Proj. 1926)
(AD-A221501; UDR-TR-88-129-Vol-2; WRDC-TR-89-3123-Vol-2)
Avail: NTIS HC A07/MF A01 CSCL 01/3

This report documents analyses which supported a study aimed at eliminating B-1B windshield problems which surfaced when the aircraft became operational. Optics and durability were immediately degraded by delamination. The many edge attachments made windshield changeout difficult and time-consuming, thereby affecting supportability. The objective of these analyses was to evaluate the impact of design configuration changes proposed to alleviate the in-service problems on the structural performance of the windshield system when subjected to birdstrike or internal cabin pressure. The MAGNA finite element analysis code was used to evaluate the structural performance of the current production configuration, which served as a baseline, and the alternate design configurations. The fasteners were evaluated based on MAGNA output using additional computer programs. Computations were made first assuming all fasteners were present, then assuming every other fastener was removed. The models and analyses are discussed and summary results for each design configuration presented. Conclusions are drawn regarding the viability of the proposed alternate design configurations in view of their impact on the structural performance of the windshield system. GRA

N90-26829# Air Force Systems Command, Wright-Patterson AFB, OH. Foreign Technology Div.
SPECIAL ESSAYS FOR THE 40TH ANNIVERSARY OF THE REVOLUTION: THE CHIEF DESIGNER DISCUSSES THE F-8 2 AND FUTURE FIGHTER PLANES
Yawei Wang 30 Mar. 1990 15 p Transl. into ENGLISH from Guoji Hangkong (Peoples Republic of China), no. 5, May 1989 p 6-8
(AD-A221587; FTD-ID(RS)T-1296-89) Avail: NTIS HC A03/MF A01 CSCL 01/3

The chief contribution of the F-8 II is an increase in combat strength. The discussion naturally began with the F-8 II, for whose development Chief Gu had been responsible. The prototype of the F-8 had been under development since 1964, and made use of the aerodynamic design of the similar F-7, using however a double engine layout. The main performance requirements were excellent high-altitude, high-speed capabilities, a relatively long range, and a relatively high rate of climb. In 1966, the preliminary stage of design was complete; on 5 July 1967 the prototype made its successful maiden flight, and the plane was delivered for use. The development of the prototype was a victim of the ten turbulent years, so the road to success was rough. The F-8 II is a new model fighter developed on the foundation of the F-8 prototype; it made its maiden flight on 12 June 1984. Its design has been finalized, and it is now in production. GRA

N90-26830# Costruzioni Aeronautiche Giovanni Agusta S.p.A., Cascina Costa (Italy). Div. Elicotteri.
DEVELOPMENT OF A METHOD TO DESIGN HELICOPTER ROTORS [SVILUPPO DI UNA METODOLOGIA DI PROGETTAZIONE DI PROFILI PER PALE DI ELICOTTERI]
Andrea Biasiol and Giuseppe Pagnano 16 Oct. 1989 7 p In ITALIAN
(Rept-100-30-03; ETN-90-97271) Avail: NTIS HC A02/MF A01

The development of a computer code for the optimization of helicopter wing design is briefly described. It is shown that first order methods are best adapted to the optimization procedures. The possibility of adopting a multiple non-linear regression to obtain an analytical surface for a fast first optimization is discussed. ESA

06 AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography.*

N90-27448# Army Avionics Lab., Fort Monmouth, NJ.
HOVER POSITION SENSING SYSTEM
Stephen P. Ahrens and Joseph McGowan (Intermetrics, Inc., Oceanport, NJ.) *In* AGARD, Tactical Applications of Space Systems May 1990 8 p (For primary document see N90-27438 21-66)
Copyright Avail: NTIS HC A07/MF A01; Non-NATO Nationals requests available only from AGARD/Scientific Publications Executive

07 AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and onboard auxilliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *44 Energy Production and Conversion.*

N90-26831# Ohio State Univ., Columbus. Dept. of Mechanical Engineering.
A HEAT TRANSFER ANALYSIS FOR ROUGH TURBINE AIRFOILS Final Report, Apr. 1986 - Mar. 1989
Lit S. Han and Majid Delpassand 16 Jan. 1990 83 p
(Contract F33615-86-K-2621; AF Proj. 3066)
(AD-A221942; AFOSR-89-2135TR) Avail: NTIS HC A05/MF A01 CSCL 21/5

In this research program, a methodology has been developed to calculate the increased heat transfer to turbine airfoils with surface roughness. The new model is adaptable to methods of finite-difference calculation, as opposed to correlation relations currently in use. The model utilizes an amplification factor for the thermal mixing length which is dependent on the local roughness height and surface shear stress. GRA

N90-26832# Aeronautical Research Labs., Melbourne (Australia). Propulsion Div.
COMPARATIVE EVALUATION OF ALLISON T56 ENGINE CHIP DETECTORS
P. J. Gage Sep. 1989 25 p
(AD-A221864; ARL-PROP-TM-469; DODA-AR-006-054) Avail: NTIS HC A03/MF A01 CSCL 17/6

Several new chip detectors were compared with types presently in use in the Allison T56 engine. The detectors were ranked according to the mass of debris collected in a set period. The tests indicated that two of the new plugs gave satisfactory performance, and hence could be used as replacements for current types. Two of the new plugs gave lower performance than existing plugs. GRA

N90-26814# Systems Research Labs., Inc., Dayton, OH. NDE Systems Div.
A GENERAL DISCUSSION OF THE RETIREMENT FOR CAUSE INSPECTION SYSTEM
Wally C. Hoppe *In* AFWAL, Proceedings of the 1987 Aircraft/Engine Structural Integrity Program (ASIP/ENSIP)

Conference Jun. 1988 p 530-542 (For primary document see N90-26807 21-05)
(Contract F33615-81-C-5002)
Avail: NTIS HC A99/MF E06 CSCL 11D

N90-26898*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
MODELING OF SUPERSONIC REACTING FLOW FIELDS
J. P. Drummond and H. S. Mukunda *In* Sandia National Labs., Summary of Discussions at the Eleventh Meeting of the Sandia Cooperative Group on the Aerothermochemistry of Turbulent Combustion Oct. 1988 p 10-20 (For primary document see N90-26896 21-25)
Avail: NTIS HC A03/MF A01 CSCL 21E

08 AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

For related information see also *05 Aircraft Design, Testing and Performance.*

N90-26833# Air Force Systems Command, Wright-Patterson AFB, OH. Foreign Technology Div.
THE ROLE OF C(SUB n BETA.DYN) IN THE AIRCRAFT STABILITY AT HIGH ANGLES OF ATTACK
Zhidai He 30 Mar. 1990 16 p Transl. into ENGLISH from Hangkong Xuebao (Peoples Republic of China), v. 9, no. 10, 1988 p B462-B468
(AD-A221586; FTD-ID(RS)T-1187-89) Avail: NTIS HC A03/MF A01 CSCL 01/1

Concrete examples of calculations are used to analyze the reliability of C(sub n beta.dyn) as a stability criterion at high angles of attack, and deductions are made regarding the errors that may result from the use of this criterion. Results were obtained that will be of value in the use of this criterion. GRA

N90-26834# Aeritalia S.p.A., Turin (Italy). Gruppo Aerei da Difesa.
NEW INFLIGHT EXPERIMENTS TO MEASURE AERODYNAMICS LOADS [NUOVE ESPERIENZE NEL RILIEVO IN VOLO DI CARICHI AERODINAMICI]
P. Duranti and B. Bellati 1989 12 p In ITALIAN Presented at the 10th Congresso Nazionale, Pisa, Italy, 16-19 Oct. 1989
(ETN-90-97276) Avail: NTIS HC A03/MF A01

The flight load survey experience gained in the tornado and AMX aircraft programs is described. The accuracy and cost of the extensometric procedures is analyzed. They are based on multiple solid state microtransducers distributed on the active surfaces. The new methodology is more accurate and reliable, and has thus been adopted. ESA

09 RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tubes; and aircraft engine test stands.

For related information see also *14 Ground Support Systems and Facilities (Space).*

N90-26835# Federal Aviation Administration, Atlantic City, NJ.
ATLANTA TOWER SIMULATION, VOLUME 1
Lloyd Hitchock, Lee E. Paul, Ephraim Shochet, and Richard D. Algeo Nov. 1989 82 p
(Contract F2006C)
(DOT/FAA/CT-TN89/27-Vol-1) Avail: NTIS HC A05/MF A01

At the request of the Atlanta (ATL) Facility, the Technical Center conducted dynamic real-time simulations of selected aspects of the Atlanta Tower's Airport Enhancement Plan. Atlanta controllers, who served as subjects, evaluated traffic flow to a three runway configuration with both a third parallel runway, 3000 feet south of existing runway 9R and a 30 degree converging runway. Large numbers of blunders (deviations of inbound aircraft away from their assigned localizer paths) were introduced to exercise the proposed system. In over 90 blunders during approaches to the third parallel runway, 5 resulted in closure distances between aircraft small enough to merit detailed analysis. The smallest horizontal distance involved 30 degree blunders across the 3000-foot separation with four of these also simulating a complete loss of communications. The overall simulation results demonstrated the controllers' ability to maintain an orderly flow of traffic to both the triple parallel and converging runway configurations. When repeatedly challenged by the unlikely combination of 30 degree NORDO blunders, 94 percent were managed without incident. The decision on runway separation distances for new construction of runways in Atlanta should not be based solely on the results of this simulation. Additional relevant data is now available which could affect the results, including navigation data from Chicago O'Hare, and automation and radar data being collected at Memphis, TN and Raleigh-Durham, NC. Potential capacity restraints are possible based on a combination of flight technical error around the localizer and a normal operating zone reduced to 500 feet. There are a number of ongoing technological innovations to be considered, as well as associated automation features, which are being tested by the high update radar sensors at Raleigh-Durham and Memphis. Author

N90-26836# Federal Aviation Administration, Atlantic City, NJ.
ATLANTA TOWER SIMULATION. VOLUME 2: APPENDIXES
Lloyd Hitchock, Lee E. Paul, Ephraim Shochet, and Richard D. Algeo Nov. 1989 267 p
(Contract F2006C)
(DOT/FAA/CT-TN89/27-Vol-2) Avail: NTIS HC A12/MF A02

Appendixes for the Atlanta Tower simulation, a series of real-time simulations of selected aspects of the Atlanta Tower's Airport Enhancement Plan, are given. Data on traffic flow to a three runway configuration with a third runway 3000 feet south of existing runway 9R and a 30 degree converging runway is given in chart and tabular form. Author

N90-26837# National Inst. of Standards and Technology, Boulder, CO. Electromagnetic Fields Div.
FACILITIES FOR IMPROVING EVALUATIONS OF ELECTROMAGNETIC SUSCEPTIBILITIES OF WEAPON SYSTEMS AND ELECTRONIC EQUIPMENT
M. T. Ma and M. L. Crawford Nov. 1989 21 p Sponsored in part by Naval Sea Systems Command, Washington, DC
(PB90-155862; NISTIR-89/3928) Avail: NTIS HC A03/MF A01 CSCL 14B

A preliminary design of an improved testing facility for evaluating the electromagnetic susceptibility of weapon systems and electronic equipment is presented. The facility features a combination of the transverse electromagnetic (TEM) cell for low frequency testing and the reverberating chamber for high frequency operation. As a system, a coverage of the wide spectrum from 10 kHz to 18 GHz or even to 40 GHz is possible. The TEM/reverberating combination is designed for an input impedance of 50, 75, or 100 ohms to generate a CW electric field up to 200 V/m, or a pulsed electric field up to 50 kV/m with an approximate rise time of 10 ns. The average field for the reverberating mode of operation is described in a statistical sense. Theoretical characteristics for a case study, to meet a given set of requirements, are given. Author

N90-26838# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France). Fluid Dynamics Panel.
FLUID DYNAMICS PANEL WORKING GROUP 12 ON ADAPTIVE WIND TUNNEL WALLS: TECHNOLOGY AND APPLICATIONS
Apr. 1990 153 p
(AGARD-AR-269; ISBN-92-835-0558-1) Copyright Avail: NTIS

HC A08/MF A01; Non-NATO Nationals requests available only from AGARD/Scientific Publications Executive

The results of a study by Working Group 12 of the Fluid Dynamics Panel of AGARD on adaptive-wall wind tunnels are presented. The history and state of the art of adaptive-wall technology are reviewed with regard to both the various streamlining algorithms and the existing adaptive-wall facilities; limitations and open questions of adaptive-wall methods are discussed and compared with passive-wall correction techniques; residual wall interferences are assessed; the prospects are presented for high-productivity and unsteady flow testing with adaptive walls; and recommendations are made for future developments. For individual titles, see N90-26839 through N90-26845.

N90-26839# Southampton Univ. (England).
THE AIMS AND HISTORY OF ADAPTIVE WALL WIND TUNNELS
Michael J. Goodyer, ed., J. P. Chevallier, J. C. Erickson, Jr., M. C. Lewis, Peter B. S. Lissaman, H. H. Pearcey, E. W. E. Rogers, and W. F. Hilton (National Physical Lab., Teddington, England) *In* AGARD, Fluid Dynamics Panel Working Group 12 on Adaptive Wind Tunnel Walls: Technology and Applications Apr. 1990 p 1-7 (For primary document see N90-26838 21-09)
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The adaptive wall test section has its roots in the area when flight speeds were beginning to approach transonic on the level or in dives, that is the 1930s. The object of this historical review is to place on record the more important steps in the evolution of the adaptive wall test section in its various forms from these early times up to about 1975 when the first examples of all of the modern varieties were well on their way. Author

N90-26840*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
[FACILITIES INVOLVED IN ADAPTIVE WALL RESEARCH]
Charles L. Ladson, ed. *In* AGARD, Fluid Dynamics Panel Working Group 12 on Adaptive Wind Tunnel Walls: Technology and Applications Apr. 1990 p 8-20 (For primary document see N90-26838 21-09)
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During the first meeting of the Working Group, it was apparent that the assessment and interpretation of the current level of the technology could be achieved most easily provided the information in a common format. This would also minimize any danger of misinterpretation by third parties of existing published information. As a result, the Group developed a questionnaire and distributed it to all involved in adaptive wall research. The questionnaire solicited information on the mechanical details of the facilities as well as details of the adaptation strategy itself. The scope of testing accomplished and future plans were included. The information contained in the responses is summarized. This information was the source for much of the data. Because some of the data contained in these questionnaires is not discussed elsewhere, they are reproduced in their entirety as an Appendix. The questionnaire is also presented to serve as a guide to the written responses. Author

N90-26841*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
STREAMLINING ALGORITHMS FOR COMPLETE ADAPTATION
J. C. Erickson, Jr., ed., J. P. Chevallier, Michael J. Goodyer, Hans G. Hornung, Andre Mignosi, William R. Sears, J. Smith, and Erich H. Wedemeyer (Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen, Germany, F.R.) *In* AGARD, Fluid Dynamics Panel Working Group 12 on Adaptive Wind Tunnel Walls: Technology and Applications Apr. 1990 p 21-41 (For primary document see N90-26838 21-09)
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For purposes of the adaptive-wall algorithms to be described, the modern era is considered to have begun with the simultaneous, independent recognition of the concept of matching an experimental inner flow across an interface to a computed outer flow by Chevallier, Ferri, Goodyer, Lissaman, Rubbert, and Sears. Fundamental investigations of the adaptive-wall matching concept by means of numerical simulations and theoretical considerations are described. An overview of the development and operation of 2D adaptive-wall facilities from about 1970 until the present is given, followed by similar material for 3D adaptive-wall facilities from approximately 1978 until the present. A general formulation of adaptation strategy is presented, with a theoretical basis for adaptation followed by 2D flexible, impermeable-wall applications; 2D ventilated-wall applications; 3D flexible, impermeable-wall applications; and 3D ventilated-wall applications. Representative experimental and 3D results are given, with 2D, followed by a discussion of limitations and open questions. Author

N90-26842*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
TESTING OF 3-D MODELS IN 2-D ADAPTIVE WALL TEST SECTIONS
Erich H. Wedemeyer, ed., Charles L. Ladson, J. Smith, Michael J. Goodyer, Andre Mignosi, and Hans G. Hornung (Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen, Germany, F.R.) *In* AGARD, Fluid Dynamics Panel Working Group 12 on Adaptive Wind Tunnel Walls: Technology and Applications Apr. 1990 p 42-58 (For primary document see N90-26838 21-09)
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Considerable effort was devoted to the development of two-dimensional adaptive wall test sections. The development of fully three-dimensional test sections, however, has not had this same level of effort expended. The limitations on three-dimensional research are the result of the complexity of both the mechanical design and operational aspects. Typical of the mechanical complexities are lack of readily available model and flow visualization access, and problems of sealing between adjacent walls for multi-wall types of test sections. The operational aspects are complicated by the necessity for many measurements of the boundary conditions which can be very time consuming. In three-dimensional testing, it is impossible to remove all of the boundary interference. It will be necessary, therefore, to apply residual corrections to the data. The more complex the test section shape, the more complex the calculation of the residual corrections becomes. From both the viewpoint of test section complexity and of ease of residual corrections, a simplified test section geometry is desirable. To aid in the design of simplified test sections, several researchers investigated the capabiiity of using two-dimensional adaptive wall test sections to perform three-dimensional testing. By use of this type of design, the inherent complications and limitations of the fully three-dimensional design are avoided. Strategies of adaptation used for this application are described, as well as, sample results and a discussion of some limitations of the technique. Author

N90-26843# National Aerospace Lab., Amsterdam (Netherlands).
HIGH PRODUCTIVITY TESTING
J. Smith, ed., Erich H. Wedemeyer, and Andre Mignosi (Centre d'Etudes et de Recherches, Toulouse, France) *In* AGARD, Fluid Dynamics Panel Working Group 12 on Adaptive Wind Tunnel Walls: Technology and Applications Apr. 1990 p 59-65 (For primary document see N90-26838 21-09)
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Considering investment cost, running cost, operational versatility

and flow quality, the present feeling is that a two-dimensional flexible wall test section is a near-optimum solution for production windtunnels, up to high subsonic Mach numbers. For near-sonic test conditions, ventilated walls are still unrivalled. High productivity implies the requirement of continuous testing, i.e., performing measurements while the test conditions are gradually, but continuously, varying in a controlled way. One Step Methods are not by themselves suited for continuous testing. In order to anticipate the ever varying test conditions, the necessary wall adaptation strategy must also to some extent be predictive. Such strategies are presently not well established. Therefore a possible high productivity strategy has been discussed in a somewhat speculative fashion, although supported by a little experimental and numerical evidence. Author

N90-26844*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
LIMITS OF ADAPTATION, RESIDUAL INTERFERENCES
Miroslav Mokry, ed., J. C. Erickson, Jr., Michael J. Goodyer, Andre Mignosi, Giuseppe P. Russo, J. Smith, Erich H. Wedemeyer (Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen, Germany, F.R.), and Perry A. Newman *In* AGARD, Fluid Dynamics Panel Working Group 12 on Adaptive Wind Tunnel Walls: Technology and Applications Apr. 1990 p 66-90 (For primary document see N90-26838 21-09)
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Methods of determining linear residual wall interference appear to be well established theoretically; however they need to be validated, for example by comparative studies of test data on the same model in different adaptive-wall wind tunnels as well as in passive, ventilated-wall tunnels. The GARTEur CAST 7 and the CAST 10/DOA 2 investigations are excellent examples of such comparative studies. Results to date in both one-variable and two-variable methods for nonlinear wall interference indicate that a great deal more research and validation are required. The status in 2D flow is advanced over that in 3D flow as is the case generally with adaptive-wall development. Nevertheless, it is now well established that for transonic testing with extensive supercritical flow present, significant wall interference is likely to exist in conventional ventilated test sections. Consequently, residual correction procedures require further development hand-in-hand with further adaptive-wall development. Author

N90-26845# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (Germany, F.R.).
ADAPTATION FOR UNSTEADY FLOW
Hans W. Foersching, ed. and R. Voss *In* AGARD, Fluid Dynamics Panel Working Group 12 on Adaptive Wind Tunnel Walls: Technology and Applications Apr. 1990 p 91-99 (For primary document see N90-26838 21-09)
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Wind tunnel wall interference in unsteady flow has not been as thoroughly investigated as in steady flow. In the case of unsteady flow the wind tunnel wall interference problem is much more complicated by additional parameters describing the time-dependent variation of the unsteady flow field. With the recent development of adaptive wind tunnel walls, by which steady wall effects are eliminated or significantly reduced by actively controlling flow near the walls, new possibilities for correction of wind tunnel wall interference have also emerged for unsteady flow. Prospects and concepts of experimental and analytical techniques for correction of unsteady wind tunnel wall effects, appearing with aerodynamic and aeroelastic measurements of oscillating lifting systems and bodies, are presented. First, some fundamental relations of motion-induced unsteady flow fields, basic to a physical understanding and analytical treatment of unsteady flow phenomena, are explained. Then the principal causes of unsteady wind tunnel interference are described and the practicability of adaptive wind tunnel walls to eliminate unsteady aerodynamic wall interference effects in unsteady aerodynamic and aeroelastic wind tunnel model measurements is discussed. Finally prospective wind tunnel wall corrections for motion-induced unsteady flow, applying steady flow wall adaptation and CFD-techniques, are outlined. Author

N90-26846# Fraunhofer-Gesellschaft zur Foerderung der Angewandten Forschung e.V., Freiburg (Germany, F.R.).
AN OPTICAL STUDY OF THE FLOW START-UP PROCESS IN FOUR CONVERGENT-DIVERGENT NOZZLES
Heinz Reichenbach and Klaus O. Opalka (Ballistic Research Labs., Aberdeen Proving Ground, MD.) Mar. 1990 93 p
(Contract DAJA45-89-C-0019)
(AD-A222918; E3/90; R/D-6229-A-01) Avail: NTIS HC A05/MF A01 CSCL 14/2

Large blast simulators (LBS) are specialized shock tunnels for generating decaying blast waves such as are associated with nuclear explosions. Blast simulators employ convergent-divergent nozzles at the driver exit to retard the outflow of the high-pressure driver gas and generate long flow durations. The LBS nozzle design in this study differs from the nozzle design used in previous studies in that it has the flow-initiating diaphragm mounted in the throat of the nozzle itself. When the diaphragm is ruptured, a shock forms and travels downstream into the divergent section, while a rarefaction fan travels upstream into the convergent section. No previous experimental research is known for this problem. Therefore, a shock tube test was proposed in which the diaphragm separating the high-pressure driver from the low-pressure driven section was mounted in the throat of a convergent-divergent nozzle which formed the transition from the driver to the driven section of the shock tube. The objectives of this investigation were: (1) to obtain optical records of the shock formation in the convergent-divergent nozzle immediately after rupturing the diaphragm; (2) to determine the influence of the cone angle and length of a divergent nozzle on the pressure signature in the expansion region behind the nozzle; and (3) to facilitate comparisons with one-, and two-dimensional hydrocode computations. The test set-up and the results of this experimental study are presented. GRA

N90-26847# Royal Aerospace Establishment, Bedford (England).
THE NEED FOR PLATFORM MOTION IN MODERN PILOTED FLIGHT TRAINING SIMULATORS
J. R. Hall Oct. 1989 19 p
(AD-A221720; RAE-TM-FM-35; DRIC-BR-113553) Avail: NTIS HC A03/MF A01 CSCL 05/9

This paper discusses motion cueing in piloted flight training simulators, and presents the factors that must be taken into account when assessing the need for, and benefits of, a motion platform so that informed decisions can be taken as to its training value. These factors include the role of the simulator, the handling qualities of the vehicle concerned, the tasks the pilot is required to fly, the performance he is expected to achieve and whether training considerations require him to use a similar control strategy and control activity in the simulator as in the aircraft. GRA

12 ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see *91 Lunar and Planetary Exploration.*

N90-26848# Office of the Under Secretary of Defense (Acquisitions), Washington, DC.
REPORT OF THE DEFENSE SCIENCE BOARD 1989 SUMMER STUDY ON NATIONAL SPACE LAUNCH STRATEGY
Mar. 1990 91 p
(AD-A222419) Avail: NTIS HC A05/MF A01 CSCL 22/4

The National Security Space Launch Strategy recommends: A National Security Space Launch Strategy to articulate a consistent statement of all military space launch requirements; The Advanced Launch Vehicle Program invest in propulsion and vehicle

technology, continue, directed at introducing product improvements into the existing launch vehicles (Delta, Atlas, and Titan). Commitment to develop a new family of launch vehicles should be deferred; Assess whether a DoD need for a heavy lift mission capability is likely to arise. To protect against such a contingency, a joint NASA/DoD program can be initiated to develop the 580,000 pound thrust engine which has been the focus of the ALS propulsion technology; Initiate a program to upgrade our national launch facility infrastructure and checkout philosophy. The goal should be to increase launch rate capability by a factor of two; That CINCSPACE define the system architecture to provide assured support to operational forces from space assets; Small boosters be developed to support a new class of operationally oriented satellites; The National Aerospace Plane hypersonic air breathing propulsion technology be developed through demonstration in the proposed X-vehicle. GRA

13 ASTRODYNAMICS

Includes powered and free-flight trajectories; and orbital and launching dynamics.

No abstracts in this category.

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities; ground support equipment, e.g., mobile transporters; and simulators.

For related information see also *09 Research and Support Facilities (Air).*

N90-26849*# Essex Corp., Huntsville, AL. Space Systems Group.
PAYLOAD TRAINING METHODOLOGY STUDY Final Report
Feb. 1990 359 p
(Contract NAS8-37737)
(NASA-CR-183907; NAS 1.26:183907) Avail: NTIS HC A16/MF A02 CSCL 14D

The results of the Payload Training Methodology Study (PTMS) are documented. Methods and procedures are defined for the development of payload training programs to be conducted at the Marshall Space Flight Center Payload Training Complex (PCT) for the Space Station Freedom program. The study outlines the overall training program concept as well as the six methodologies associated with the program implementation. The program concept outlines the entire payload training program from initial identification of training requirements to the development of detailed design specifications for simulators and instructional material. The following six methodologies are defined: (1) The Training and Simulation Needs Assessment Methodology; (2) The Simulation Approach Methodology; (3) The Simulation Definition Analysis Methodology; (4) The Simulator Requirements Standardization Methodology; (5) The Simulator Development Verification Methodology; and (6) The Simulator Validation Methodology. Author

N90-26850# Range Commanders Council, White Sands Missile Range, NM.
SPACE TEST RANGE Special Report
James Means Dec. 1989 33 p
(AD-A223259) Avail: NTIS HC A03/MF A01 CSCL 14/2

This briefing reviews the total Space Test Range concept and reminds the Range Commanders that because the Space Test Range is a global concept supported by all three services, they are all involved in it. I was selected to give the briefing because I had initiated the original concept, had the most experience in its evolution, and was currently serving as chairman of the Space Panel of the Multi-service Test Investments Review Committee (MSTIRC). This briefing reviews the need for the Space Test Range, examines the Test Resource Master Plan (TRMP) concepts, investigates the service proposals that were submitted to the Space Panel of the MSTIRC, shows the results of the MSTIRC review, and presents my bottom line concerns. GRA

15 LAUNCH VEHICLES AND SPACE VEHICLES

Includes boosters; operating problems of launch/space vehicle systems; and reusable vehicles.

For related information see also *20 Spacecraft Propulsion and Power.*

N90-26851# Lawrence Livermore National Lab., CA. Special Studies Group.
ASPECTS OF ACOUSTIC NOISE GENERATION BY A LASER-PROPELLED VEHICLE
I-Dee Chang (Stanford Univ., CA.) and Muriel Y. Ishikawa 18 Dec. 1989 36 p Presented at the 1987 SDIO Workshop on Laser Propulsion, Los Alamos, NM, 14-18 Sep. 1987 Submitted for publication
(Contract W-7405-eng-48)
(DE90-012087; UCRL-102561; CONF-8709489-1) Avail: NTIS HC A03/MF A01

Modeling of acoustic noise generation by a laser propulsion ground-to-space launch system is one that has previously not been examined to our knowledge. The development of large lasers funded under the auspices of the Strategic Defense Initiative, resurrected serious interest both in laser-propelled vehicles and their ramifications to the cost-effective transportation into space of significant quantities of mass. In this paper, the generation of acoustic noise by a laser-propelled vehicle is examined. Many aspects of the aero-acoustic physics associated with a ground-to-space laser propulsion launch system are believed to be unique. The analytical models presented here allow a reasonable estimate to be made of the levels of characteristic aero-acoustic noise generated by periodically-and-explosively-driven, accelerating vehicles. DOE

N90-26852# Lawrence Livermore National Lab., CA. Center for Compressible Turbulence.
ANALYSIS OF NEAR-SURFACE FLOW PHYSICS IN A TWO-STAGE, 10 km/s, ELECTROMAGNETIC LAUNCHER
Alfred C. Buckingham and Ronald S. Hawke Jun. 1990 8 p Presented at the 21st AIAA Fluid Dynamics, Plasma Dynamics and Lasers Conference in Conjunction with the AIAA 25th Thermophysics and Heat Transfer Conference and the 16th Aerodynamic Ground Testing Conference, Seattle, WA, 18-20 Jun. 1990 Previously announced in IAA as A90-38744 Submitted for publication
(Contract W-7405-eng-48)
(DE90-013292; UCRL-102303; CONF-9006153-2) Avail: NTIS HC A02/MF A01

An analysis was made of several apparently influential physical processes observed in current electromagnetic launcher performance experiments. Boundary layer and thin-film Couette flow processes in the hypervelocity range (approaching 10 km/s) are the focus of this work. The specific launch device under study has a two stage acceleration: initially a light gas projectile injection phase followed by a plasma driven Lorentz force acceleration phase. The emphasis is on understanding the concomitant influence of plasma transport, gas phase and gas/solid kinetics, skin depth, solid neutral and ionic particle seed additives on near-wall boundary layer and Couette flow processes. Studies are initiated on the effects of plasma-enriching ion additives and wall transpiration cooling with respect to increasing the integrity, performance, and launch-to-launch endurance of this type of electromagnetic launcher (EML). DOE

16 SPACE TRANSPORTATION

Includes passenger and cargo space transportation, e.g., shuttle operations; and space rescue techniques.

For related information see also *03 Air Transportation and Safety* and *18 Spacecraft Design, Testing and Performance.* For space suits see *54 Man/System Technology and Life Support.*

N90-26853*# Auburn Univ., AL. Aerospace Engineering.
SPACE SHUTTLE 2 ADVANCED SPACE TRANSPORTATION SYSTEM. VOLUME 1: EXECUTIVE SUMMARY Final Report
James N. Adinaro, Philip A. Benefield, Shelby D. Johnson, and Lisa K. Knight 27 Apr. 1989 33 p
(Contract NASw-4435)
(NASA-CR-185952; NAS 1.26:185952) Avail: NTIS HC A03/MF A01 CSCL 22B

An investigation into the feasibility of establishing a second generation space transportation system is summarized. Incorporating successful systems from the Space Shuttle and technological advances made since its conception, the second generation shuttle was designed to be a lower-cost, reliable system which would guarantee access to space well into the next century. A fully reusable, all-liquid propellant booster/orbiter combination using parallel burn was selected as the base configuration. Vehicle characteristics were determined from NASA ground rules and optimization evaluations. The launch profile was constructed from particulars of the vehicle design and known orbital requirements. A stability and control analysis was performed for the landing phase of the orbiter's flight. Finally, a preliminary safety analysis was performed to indicate possible failure modes and consequences. Author

N90-26854*# Auburn Univ., AL. Aerospace Engineering.
SPACE SHUTTLE 2 ADVANCED SPACE TRANSPORTATION SYSTEM, VOLUME 2 Final Report
James N. Adinaro, Philip A. Benefield, Shelby D. Johnson, and Lisa K. Knight 27 Apr. 1989 91 p Sponsored by NASA, Washington
(NASA-CR-185953; NAS 1.26:185953) Avail: NTIS HC A05/MF A01 CSCL 22B

To determine the best configuration from all candidate configurations, it was necessary first to calculate minimum system weights and performance. To optimize the design, it is necessary to vary configuration-specific variables such as total system weight, thrust-to-weight ratios, burn durations, total thrust available, and mass fraction for the system. Optimizing each of these variables at the same time is technically unfeasible and not necessarily mathematically possible. However, discrete sets of data can be generated which will eliminate many candidate configurations. From the most promising remaining designs, a final configuration can be selected. Included are the three most important designs considered: one which closely approximates the design criteria set forth in a Marshall Space Flight Center study of the Shuttle 2; the configuration used in the initial proposal; and the final configuration. A listing by cell of the formulas used to generate the aforementioned data is included for reference. Author

17 SPACE COMM., SPACECRAFT COMM., COMMAND & TRACKING

Includes telemetry; space communications networks; astronavigation and guidance; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications and Radar.*

No abstracts in this category.

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes satellites; space platforms; space stations; spacecraft systems and components such as thermal and environmental controls; and attitude controls.

For life support systems see *54 Man/System Technology and Life Support.* For related information see also *05 Aircraft Design, Testing and Performance, 39 Structural Mechanics,* and *16 Space Transportation.*

N90-26855*# Illinois Univ., Urbana-Champaign. Dept. of Engineering.
NASA/USRA UNIVERSITY ADVANCED DESIGN PROGRAM Final Report, 1988-1989
Michael F. Lembeck and John Prussing 15 Jun. 1989 23 p
(Contract NASw-4435)
(NASA-CR-186050; NAS 1.26:186050) Avail: NTIS HC A03/MF A01 CSCL 22B

The participation of the University of Illinois at Urbana-Champaign in the NASA/USRA University Advanced Design Program for the 1988 to 1989 academic year is reviewed. The University's design project was the Logistics Resupply and Emergency Crew Return System for Space Station Freedom. Sixty-one students divided into eight groups, participated in the spring 1989 semester. A presentation prepared by three students and a graduate teaching assistant for the program's summer conference summarized the project results. Teamed with the NASA Marshall Space Flight Center (MSFC), the University received support in the form of remote telecon lectures, reference material, and previously acquired applications software. In addition, a graduate teaching assistant was awarded a summer 1989 internship at MSFC. Author

N90-26856*# Virginia Univ., Charlottesville. School of Engineering and Applied Science.
LUNAR LANDER CONCEPTUAL DESIGN
Joo Ahn Lee, John Carini, Andrew Choi, Robert Dillman, Sean J. Griffin, Susan Hanneman, Caesar Mamplata, and Edward Stanton 17 May 1989 143 p
(Contract NASw-4435)
(NASA-CR-186233; NAS 1.26:186233) Avail: NTIS HC A07/MF A01 CSCL 22B

A conceptual design is presented of a Lunar Lander, which can be the primary vehicle to transport the equipment necessary to establish a surface lunar base, the crew that will man the base, and the raw materials which the Lunar Station will process. A Lunar Lander will be needed to operate in the regime between the lunar surface and low lunar orbit (LLO), up to 200 km. This lander is intended for the establishment and operation of a manned surface base on the moon and for the support of the Lunar Space Station. The lander will be able to fulfill the requirements of 3 basic missions: A mission dedicated to delivering maximum payload for setting up the initial lunar base; Multiple missions between LLO and lunar surface dedicated to crew rotation; and Multiple missions dedicated to cargo shipments within the regime of lunar surface and LLO. A complete set of structural specifications is given. Author

N90-26857# National Aerospace Lab., Amsterdam (Netherlands). Space Div.
TWO-PHASE HEAT TRANSPORT SYSTEMS FOR SPACECRAFT SCALING WITH RESPECT TO GRAVITY
A. A. M. Delil 31 Mar. 1989 14 p Presented at 19th Intersociety Conference on Environmental Systems International Thermal Control Session, San Diego, CA, 24-27 Jul. 1989 and 26th National Heat Transfer Conference Open Forum Session, Philadelphia, PA, 6-9 Aug. 1989 Previously announced in IAA as A90-27435
(Contract NIVR-2404N)
(NLR-TP-89127-U; ETN-90-97185) Avail: NTIS HC A03/MF A01

Aspects of gravitational scaling of spacecraft two phase heat transport systems are discussed. Supporting similitude

considerations, based on dimension analysis are given. The investigation is performed for a better understanding of two phase flow and heat transfer phenomena, in order to provide means for the comparison and generalization of data, and in order to develop a tool for the design af two phase flow and systems components. It is shown that only distorted scaling offers possibilities when only loop sections are involved. ESA

N90-26858*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.
HYPERVELOCITY IMPACT SHIELD Patent Application
Burton G. Cour-Palais, inventor (to NASA) and Jeanne Lee Crews, inventor (to NASA) 30 Apr. 1990 24 p
(NASA-Case-MSC-21420-1; NAS 1.71:MSC-21420-1; US-Patent-Appl-SN-516573) Avail: NTIS HC A03/MF A01 CSCL 22B

A hypervelocity impact shield and method for protecting a wall structure, such as a spacecraft wall, from impact with particles of debris having densities of about 2.7 g/cu cm and impact velocities up to 16 km/s are disclosed. The shield comprises a stack of ultra thin sheets of impactor disrupting material supported and arranged by support means in spaced relationship to one another and mounted to cover the wall in a position for intercepting the particles. The sheets are of a number and spacing such that are impacting particle and the resulting particulates of the impacting particle and sheet material are successively impact-shocked to a thermal state of total melt and/or vaporization to a degree as precludes perforation of the wall. The ratio of individual sheet thickness to the theoretical diameter of particles of debris which may be of spherical form is in the range of 0.03 to 0.05. The spacing between adjacent sheets is such that the debris cloud plume of liquid and vapor resulting from an impacting particle penetrating a sheet does not puncture the next adjacent sheet prior to the arrival thereat of fragment particulates of sheet material and the debris particle produced by a previous impact. NASA

N90-26859*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.
OVERCENTER COLLET SPACE STATION TRUSS FASTENER Patent Application
Philip L. Sheridan, inventor (to NASA) 30 Apr. 1990 18 p
(NASA-Case-MSC-21504-1; NAS 1.71:MSC-21504-1; US-Patent-Appl-SN-516856) Avail: NTIS HC A03/MF A01 CSCL 22B

A quick-connect fastener is arranged with a tubular body that is arranged to be engaged against the exterior surface of a hollow attachment fitting and coincidentally aligned with an opening in the fitting. A collet having normally-contracted fingers with outwardly-enlarged ends is operatively arranged in the body to be moved forwardly by an expander member mounted in the tubular body for advancing the collet fingers through the opening in the attachment fitting. Biasing means are arranged between the expander member and a toggle linkage in the tubular body which is selectively operated to urge the expander member forwardly into engagement with the collet fingers with an initial biasing force to advance their forward portions through the body opening and then expand them outwardly. The biasing means also provide a subsequent biasing force for retaining the collet members in their expanded positions once their enlarged forward end portions are on the opposite side of the body. NASA

N90-26860*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.
SEMI-ACTIVE ORBITAL DEBRIS SWEEPER Patent Application
Andrew J. Petro, inventor (to NASA) 16 Feb. 1990 16 p
(NASA-Case-MSC-21534-1; NAS 1.71:MSC-21534-1; US-Patent-Appl-SN-480985) Avail: NTIS HC A03/MF A01 CSCL 22B

An orbital debris sweeper is provided for removing particles from orbit which otherwise may impact and damage an orbiting spacecraft. The debris sweeper includes a central sweeper core which carries a debris monitoring unit, and a plurality of large area impact panels rotatable about a central sweeper rotational axis. In response to information from the debris monitoring unit, a computer determines whether individual monitored particles preferably impact one of the rotating panels or pass between the rotating panels. A control unit extends or retracts one or more booms which interconnect the sweeper core and the panels to change the moment of inertia of the sweeper and thereby the rotational velocity of the rotating panels. According to the method of the present invention, the change in panel rotational velocity increases the frequency of particles which desirably impact one of the panels and are thereby removed from orbit, while large particles which may damage the impact panels pass between the trailing edge of one panel and the leading edge of the rotationally succeeding panel. NASA

N90-26861*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, AL.
CLOSED-LOOP AUTONOMOUS DOCKING SYSTEM Patent Application
Richard Dabney, inventor (to NASA) and Richard Howard, inventor (to NASA) 20 Feb. 1990 29 p
(NASA-Case-MFS-28421-1; NAS 1.71:MFS-28421-1; US-Patent-Appl-SN-481537) Avail: NTIS HC A03/MF A01 CSCL 22B

An autonomous docking system is provided which produces commands for the steering and propulsion system of a chase vehicle used in the docking of that chase vehicle with a target vehicle. The docking system comprises a passive optical target affixed to the target vehicle and comprising three reflective areas including a central area mounted on a short post, and tracking sensor and process controller apparatus carried by the chase vehicle. The latter apparatus comprises a laser diode array for illuminating the target so as to cause light to be reflected from the reflective areas of the target; a sensor for detecting the light reflected from the target and for producing an electrical output signal in accordance with an image of the reflected light; a signal processor for processing the electrical output signal in accordance with an image of the reflected light; a signal processor for processing the electrical output signal and for producing, based thereon, output signals relating to the relative range, roll, pitch, yaw, azimuth and elevation of the chase and target vehicles; and a docking process controller, responsive to the output signals produced by the signal processor, for producing command signals for controlling the steering and propulsion system of the chase vehicle. NASA

N90-26862# Massachusetts Inst. of Tech., Cambridge. Space Systems Lab.
LOCAL DESIGN METHODOLOGIES FOR A HIERARCHIC CONTROL ARCHITECTURE Final Report, 9 Jan. 1988 - 30 Jun. 1989
Jonathan P. How, Steven R. Hall, and Edward F. Crawley 12 Apr. 1990 217 p
(Contract F49620-88-C-0015; AF Proj. 2302)
(AD-A222006; MIT-SSL-14-89; AFOSR-90-0524TR) Avail: NTIS HC A10/MF A02 CSCL 22/2

The problems associated with the control of large intelligent space structures with many sensors and actuators has previously led to the development of a hierarchic control architecture. This control arrangement consists of a two level combination of a centralized global controller and a set of local controllers which are distributed to complement the dynamic behavior of the structure. Four decentralized control methodologies which are suitable for implementation at the lower level of the hierarchic architecture are develcped and analyzed in this thesis. The first design only allows colocated feedback. The second design allows feedback from within a region of the structure. The third allows communication between adjacent local controllers so that information from neighboring regions can be used for the feedback. The last employs a distributed implementation of the full state feedback. The simulation results for the control of a long beam in bending show that employing the more complicated decentralized designs at the lower level of the hierarchic architecture will slightly improve the overall performance. However, the implementation

costs for these more sophisticated designs are shown to increase dramatically. The most efficient hierarchic design for this beam example is one which combines a good global design with a simple colocated feedback. This conclusion may change for structures which require more performance at the local level. GRA

N90-26863# Howard Univ., Washington, DC. Dept. of Mechanical Engineering.
CONTROL OF ORBITING LARGE SPACE STRUCTURAL SYSTEMS WITH DISCRETE TIME OBSERVATIONAL DATA AND RANDOM MEASUREMENT NOISE Final Report, 29 Jul. 1988 - 28 Feb. 1989
Peter M. Bainum, Xing Guangqian, and Aprille J. Ericsson Mar. 1990 75 p
(Contract F33615-88-C-3208; AF Proj. 2401)
(AD-A222476; WRDC-TR-90-3012) Avail: NTIS HC A04/MF A01 CSCL 22/3

The objective of this research is to develop practical design procedures that can be used in conjunction with optimal digital controllers and estimators for future orbiting large space structural systems. In practice, observational data used to verify the orientation and shape of large flexible systems will, in general, be collected on a sampled basis (discrete time data system). Random noise is also included with such observational data. Systems which will be designed to control both the overall orientation as well as the shape of some of the subsystems (such as an antenna mesh form) must function in the discrete-time domain. The aim of this research is to develop methods that can be used to design linear quadratic Gaussian (LQG) controllers/ estimators for orbiting large flexible systems. The digital control of an orbiting shallow shell antenna-type system, as well as flexible platform-type systems are examined. GRA

N90-26864# Michigan Univ., Ann Arbor. Dept. of Electrical Engineering and Computer Science.
AIMING CONTROL: THEORY AND APPLICATIONS TO DYNAMIC CONTROL OF SPACE STRUCTURES Final Report, 1 Aug. 1987 - 31 Jul. 1989
Semyon M. Meerkov 25 Jul. 1989 90 p
(Contract F49620-87-C-0079; AF Proj. 2304)
(AD-A221532; AFOSR-90-0520TR) Avail: NTIS HC A05/MF A01 CSCL 22/2

The goal is the investigation of fundamental bounds on the maximal achievable precision of aiming of dynamical systems with random perturbations and application of these bounds to control of space structures. To this end, the following results were obtained: it was shown that linear systems with small additive noise can be pointed with any desired accuracy by output feedback if and only if the system is invertable and minimum phase in an approximate sense; when the measurements noise is present, the maximal achievable precision of aiming is bounded, even if the conditions mentioned above are satisfied; thus, the measurement noise has a more severe effect on the pointability of dynamical system than the input noise. In addition, the problem of residence probability control was investigated and its relation to the problem of residence time control was analyzed. GRA

N90-26865# Air Force Systems Command, Wright-Patterson AFB, OH. Foreign Technology Div.
THE MAIN PRODUCTS AND THEIR DISTRIBUTION OF FY-1 METEOROLOGICAL SATELLITE
Zongyi Fang 16 Apr. 1990 11 p Transl. into ENGLISH from Chinese Journal of Meteorology (Peoples Republic of China), v. 14, no. 10, p 10-13
(AD-A221582; FTD-ID(RS)T-1065-89) Avail: NTIS HC A03/MF A01 CSCL 08/2

The main products derived and reduced from the raw data of FY-1 meteorological satellite by the processing system of the Satellite Meteorological Center and their processing and analyzing methods are given. They are imagery products, digital and map products, and analysis and special service products. The method of distribution of the products is also explained. The main detector of the Fong Yuen-1 (FY-1) meteorological satellite is a five channel high resolution radiation scanner. Among them, the data obtained from the three channels of visible light, near infrared light and infrared light can be processed to obtain the daytime and night cloud map, ice-snow covering map, vegetation covering map, sea surface temperature distribution map and earth surface reflection map. GRA

N90-26866# Optron Systems, Inc., Bedford, MA.
OPTICAL WAVEFRONT COMPUTER FOR STABILIZING LARGE SPACE STRUCTURES Final Technical Report, 1 Sep. 1989 - 28 Feb. 1990
Ira Farber 1 Sep. 1989 26 p
(Contract N00014-89-C-0223)
(AD-A221707) Avail: NTIS HC A03/MF A01 CSCL 20/6

This final report investigates a new adaptive optics system architecture for wavefront correction based primarily on optical processing. The highlights are: (1) The design of a new adaptive optics system architecture incorporating optical rather than electronic processing for wavefront sampling and reconstruction. Unlike conventional adaptive systems incorporating electronic processors, the new optical system exhibits a framing rate that is independent of the sampling and reconstruction resolutions. (2) An analysis of requirements and specifications for all major components needed to implement the new optical architecture, including a lenslet array, an image intensifier tube, an optically addressed binary amplitude spatial light modulator, a transmission mask, a computer generated wavefront reconstruction hologram and an optically addressed phase modulator. (3) Design of the minimum mean square error phase reconstruction hologram. GRA

N90-26867# Virginia Univ., Charlottesville. Dept. of Applied Mathematics.
INCREASING THE MARGIN OF STABILITY OF ARBITRARILY FINITE MODES OF FLEXIBLE LARGE SPACE STRUCTURES WITH DAMPING Final Report, 1 Sep. 1987 - 30 Nov. 1989
R. Triggiani and I. Lasiecka 22 Feb. 1990 18 p
(Grant AF-AFOSR-0321-87)
(AD-A221742; UVA/525701/AM90/101) Avail: NTIS HC A03/MF A01 CSCL 12/1

This final report summarizes the principal investigators' achievements on the research project during the period September 1, 1987 through November 30, 1989. These include new results for wave equations and plate equations, linear and nonlinear, on the following problems: exact controllability, strong and uniform stabilization, structural damping, quadratic optimal control problem, Riccati equations, robustness with respect to nonlinear uncertainties, and numerical aspects. GRA

N90-26868# Universitaet der Bundeswehr Muenchen, Neubiberg (Germany, F.R.). Inst. fuer Raumfahrttechnik.
HYDROELASTIC PROBLEMS IN SPACE FLIGHT VEHICLES
Helmut Franz Bauer 1989 34 p
(LRT-WE-9-FB-11(1989); ETN-90-97342) Avail: NTIS HC A03/MF A01

The hydroelastic behavior of an incompressible and frictionless liquid with a free surface was investigated for a cylindrical container. Coupled frequencies for non-rotating and rotating containers are presented. Through the coupling of liquid and structure the frequency may be removed from areas dangerous to the overall stability of the space vehicle. The instability may be removed by the inclusion of liquid. ESA

N90-27141*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
SPACE STATION ATTACHED PAYLOADS
Lenwood G. Clark *In its* Earth Sciences Requirements for the Information Sciences Experiment System Jul. 1990 p 7-20
(For primary document see N90-27140 21-43)
Avail: NTIS HC A10/MF A02 CSCL 22B

N90-27295*# Honeywell, Inc., Minneapolis, MN. Systems and Research Center.
ATTITUDE DETERMINATION AND CONTROL SYSTEM (ADCS) AND MAINTENANCE AND DIAGNOSTIC SYSTEM (MDS): A MAINTENANCE AND DIAGNOSTIC SYSTEM FOR SPACE STATION FREEDOM
David Toms, George D. Hadden, and Jim Harrington (Honeywell, Inc., Clearwater, FL.) *In* NASA, Marshall Space Flight Center, Fifth Conference on Artificial Intelligence for Space Applications May 1990 p 175-183 Sponsored in part by McDonnell-Douglas Space Systems Co. (For primary document see N90-27275 21-61)
(Contract NAS9-18200)
Avail: NTIS HC A25/MF A04 CSCL 22B

N90-27299*# Boeing Computer Support Services, Inc., Huntsville, AL. Artificial Intelligence Center.
GRAPHICAL EXPLANATION IN AN EXPERT SYSTEM FOR SPACE STATION FREEDOM RACK INTEGRATION
F. G. Craig, D. E. Cutts, T. R. Fennel, and B. Purves (Boeing Aerospace Co., Huntsville, AL.) *In* NASA, Marshall Space Flight Center, Fifth Conference on Artificial Intelligence for Space Applications May 1990 p 211-219 (For primary document see N90-27275 21-61)
Avail: NTIS HC A25/MF A04 CSCL 22B

N90-27300*# McDonnell-Douglas Space Systems Co., Houston, TX.
SPACE STATION ADVANCED AUTOMATION
Donald Woods *In* NASA, Marshall Space Flight Center, Fifth Conference on Artificial Intelligence for Space Applications May 1990 p 221-230 (For primary document see N90-27275 21-61)
(Contract NAS9-18200)
Avail: NTIS HC A25/MF A04 CSCL 22B

N90-27452# Defense Communications Agency, Washington, DC. Military Satellite Communications System Office.
THE POST-2000 MILSATCOM ARCHITECTURE
Robert L. Drummond and Gregory B. Frick *In* AGARD, Tactical Applications of Space Systems May 1990 7 p (For primary document see N90-27438 21-66)
Copyright Avail: NTIS HC A07/MF A01; Non-NATO Nationals requests available only from AGARD/Scientific Publications Executive

N90-27453# Massachusetts Inst. of Tech., Lexington. Lincoln Lab.
LIGHTWEIGHT EHF COMMUNICATIONS SATELLITES
David R. McElroy, Dean P. Kolba, and Marilyn D. Semprucci *In* AGARD, Tactical Applications of Space Systems May 1990 10 p (For primary document see N90-27438 21-66)
Copyright Avail: NTIS HC A07/MF A01; Non-NATO Nationals requests available only from AGARD/Scientific Publications Executive

19 SPACECRAFT INSTRUMENTATION

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography.*

N90-26869*# Utah State Univ., Logan. Space Dynamics Lab.
CONCEPTUAL DESIGN STUDY FOR INFRARED LIMB EXPERIMENT (IRLE)
Doran J. Baker, Jim Ulwick, Roy Esplin, J. C. Batty, Gene Ware, and Craig Tew Sep. 1989 162 p
(Grant NAG1-899)
(NASA-CR-186950; NAS 1.26:186950; SDL/89-083) Avail: NTIS HC A08/MF A01 CSCL 14B

The phase A engineering design study for the Infrared Limb Experiment (IRLE) instrument, the infrared portion of the Mesosphere-Lower Thermosphere Explorer (MELTER) satellite payload is given. The IRLE instrument is a satellite instrument, based on the heritage of the Limb Infrared Monitor of the Stratosphere (LIMS) program, that will make global measurements of O3, CO2, NO, NO2, H2O, and OH from earth limb emissions. These measurements will be used to provide improved understanding of the photochemistry, radiation, dynamics, energetics, and transport phenomena in the lower thermosphere, mesosphere, and stratosphere. The IRLE instrument is the infrared portion of the MELTER satellite payload. MELTER is being proposed to NASA Goddard by a consortium consisting of the University of Michigan, University of Colorado and NASA Langley. It is proposed that the Space Dynamics Laboratory at Utah State University (SDL/USU) build the IRLE instrument for NASA Langley. MELTER is scheduled for launch in November 1994 into a sun-synchronous, 650-km circular orbit with an inclination angle of 97.8 deg and an ascending node at 3:00 p.m. local time. Author

20 SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components, e.g., rocket engines; and spacecraft auxilliary power sources.

For related information see also *07 Aircraft Propulsion and Power, 28 Propellants and Fuels, 44 Energy Production and Conversion,* and *15 Launch Vehicles and Space Vehicles.*

N90-26870*# Atlantic Research Corp., Gainesville, VA. Propulsion Div.
HYBRID PROPULSION TECHNOLOGY PROGRAM Final Report
31 Jan. 1990 332 p
(Contract NAS8-37776)
(NASA-CR-183952; NAS 1.26:183952) Avail: NTIS HC A15/MF A02 CSCL 21H

Technology was identified which will enable application of hybrid propulsion to manned and unmanned space launch vehicles. Two design concepts are proposed. The first is a hybrid propulsion system using the classical method of regression (classical hybrid) resulting from the flow of oxidizer across a fuel grain surface. The second system uses a self-sustaining gas generator (gas generator hybrid) to produce a fuel rich exhaust that was mixed with oxidizer in a separate combustor. Both systems offer cost and reliability improvement over the existing solid rocket booster and proposed liquid boosters. The designs were evaluated using life cycle cost and reliability. The program consisted of: (1) identification and evaluation of candidate oxidizers and fuels; (2) preliminary evaluation of booster design concepts; (3) preparation of a detailed point design including life cycle costs and reliability analyses; (4) identification of those hybrid specific technologies needing improvement; and (5) preperation of a technology acquisition plan and large scale demonstration plan. E.R.

N90-26871*# National Inst. of Standards and Technology, Gaithersburg, MD. Precision Engineering Div.
ACCURACY ANALYSIS OF THE SPACE SHUTTLE SOLID ROCKET MOTOR PROFILE MEASURING DEVICE
W. Tyler Estler Nov. 1989 79 p
(NASA-TM-101131; NAS 1.15:101131; PB90-148362; NISTIR-89/4171) Avail: NTIS HC A05/MF A01 CSCL 21H

The Profile Measuring Device (PMD) was developed at the George C. Marshall Space Flight Center following the loss of the Space Shuttle Challenger. It is a rotating gauge used to measure the absolute diameters of mating features of redesigned Solid Rocket Motor field joints. Diameter tolerance of these features are typically + or - 0.005 inches and it is required that the PMD absolute measurement uncertainty be within this tolerance. In this analysis, the absolute accuracy of these measurements were found to be + or - 0.00375 inches, worst case, with a potential accuracy of + or - 0.0021 inches achievable by improved temperature control. Author

N90-26872*# Johns Hopkins Univ., Laurel, MD. Chemical Propulsion Information Agency.
ADVANCED PROPULSION CONCEPTS
Debra S. Eggleston, ed. and Karen L. Strange, ed. 24 May 1989 115 p Presented at the Advanced Propulsion Concepts Specialist Session, Cleveland, OH, 23-25 May 1989
(Contract N00039-89-C-0001)
(NASA-CR-185920; NAS 1.26:185920; CPIA-Publ-528) Avail: NTIS HC A06/MF A01 CSCL 21H

Six papers presented at the Advanced Propulsion Concepts Specialist Session held in conjunction with the 1989 Joint Army-Navy-NASA-Air Force (JANNAF) Propulsion Meeting in Cleveland, OH on 23 to 25 May 1989 are given. Subjects discussed include advanced propulsion concepts, antiproton propulsion, and high energy density matter. Author

N90-26873*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
NUCLEAR POWER SYSTEMS FOR LUNAR AND MARS EXPLORATION
R. J. Sovie and J. M. Bozek 1990 12 p Proposed for presentation at the 41st International Astronautical Conference, Dresden, German Democratic Republic, 6-13 Oct. 1990
(NASA-TM-103168; E-5540; NAS 1.15:103168; IAF-90-200)
Avail: NTIS HC A03/MF A01 CSCL 18L

Initial studies of a variety of mission scenarios for the new Space Exploration Initiative, and the technologies necessary to enable or significantly enhance them, have identified the development of advanced space power systems whether solar, chemical or nuclear to be of prime importance. Lightweight, compact, reliable power systems for planetary rovers and a variety of surface vehicles, utility surface power, and power for advanced propulsion systems have been identified as critical needs for these missions. These mission scenarios, the concomitant power system requirements, and power system options considered are discussed. The significant potential benefits of nuclear power are identified for meeting the power needs of the above applications. Author

N90-26874# Johns Hopkins Univ., Laurel, MD. Applied Physics Lab.
SPACE PROPULSION HAZARDS ANALYSIS MANUAL (SPHAM), VOLUME 1
Dorothy L. Becker, ed. Dec. 1989 514 p
(Contract N00039-89-C-0001)
(AD-A219607; CPIA-Publ-494-Vol-1) Avail: NTIS HC A22/MF A03 CSCL 21/8

The Space Propulsion Hazards Analysis Manual (SPHAM) is a compilation of methods and data directed at hazards analysis and safety for space propulsion and associated vehicles, but broadly applicable to other environments and systems. Methods are described of compiling relevant regulatory documentation, deriving design requirements and specifications, modeling accident scenarios in formal risk assessments, and correlation real-time data to risk probability modeling. Also, SPHAM provides methods for predicting post-accident blast, fragmentation, thermal, and environmental damage. Included in the appendices are an exhaustive bibliography, hazardous properties information on selected space propulsion commodities, and system descriptions of various launch vehicles, upper stages, and spacecrafts. Author

N90-26875# Johns Hopkins Univ., Laurel, MD. Applied Physics Lab.
SPACE PROPULSION HAZARDS ANALYSIS MANUAL (SPHAM), VOLUME 2
Dorothy L. Becker, ed. Dec. 1989 1162 p
(Contract N00039-89-C-0001)
(AD-A219608; CPIA-Publ-494-Vol-2) Avail: NTIS HC A99/MF E09 CSCL 21/8

The Space Propulsion Hazards Analysis Manual (SPHAM) contains an exhaustive bibliography, hazardous properties information on selected space propulsion commodities, and system descriptions of various launch vehicles, upper stages, and spacecrafts. Author

N90-26876# Air Force Inst. of Tech., Wright-Patterson AFB, OH. School of Engineering.
TRAJECTORY OPTIMIZATION OF A BIMODAL NUCLEAR POWERED SPACECRAFT TO MARS M.S. Thesis
Steven Robert Oleson 29 May 1990 172 p
(AD-A222974; AFIF/GA/ENY/90J-1) Avail: NTIS HC A08/MF A01 CSCL 03/3

Minimum flight times for a bimodal, nuclear powered spacecraft are sought. A direct trajectory from Earth to Mars is utilized. Earth escape and Mars braking is accomplished with a high thrust, nuclear thermal propulsion unit, while the interplanetary transit is achieved by a low thrust, electric propulsion unit whose thrusting direction may be varied. An existing method that maximizes circular orbit transfer is adapted to the problem by simplifying the escape and braking conditions and requiring the final orbit to be that of Mars, thus obtaining minimum flight times. Low thrust direction history, phi(t), excess high thrust fuel division between the escape and braking burns, and optimal escape injection angles are found that determine the minimum flight time. Finally, the size of the low thrust propulsion is also varied to find the minimum time of flight. GRA

N90-26877# Wasatch Research and Engineering, Inc., Salt Lake City, UT.
FLOW INDUCED NUTATION INSTABILITY IN SPINNING SOLID PROPELLANT ROCKETS Final Report, 1 Sep. 1988 - 1 Sep. 1989
G. A. Flandro, M. Leloudis, and R. Roach Apr. 1990 191 p
(Contract F04611-88-C-0014; AF Proj. 5730)
(AD-A222504; AL-TR-89-084) Avail: NTIS HC A09/MF A02 CSCL 22/4

Rocket motor internal ballistics on the observed coning instability of spinning, orbit raising propulsion stages were studied. This phenomenon appeared in the PAM-D (STAR 48) vehicles. Unexpected coning appeared near the end of motor burn with final cone angles nearly 15 deg. Earlier vehicles of similar design were not afflicted. While no PAM missions were lost, lighter vehicles using the same propulsion concept and spin stabilization could be jeopardized. The exact cause of the instability needs to be found and corrected at the design stage. A better understanding is needed for attitude control systems to be designed on a rational basis. Capability to estimate nutation amplitudes is needed in system design decisions. These needs are met in the form of rational scaling laws that allow extension of experimental data to motor/spacecraft configurations. Numerous physical mechanisms have been proposed to explain the PAM-D disturbing torque with most eliminated by failure to comply with telemetry data. Two mechanisms still remain to be more fully evaluated. One is the slag sloshing hypothesis, which links the instability to sloshing of accumulations of aluminum oxide slag within the aft closure of the rocket motor combustion chamber. This study focused on force and torque caused by interaction of the motor internal gas flow with the wobbling motions of the spacecraft. GRA

N90-26878# Naval Research Lab., Washington, DC. Directed Energy Effects Branch.
SOLID ROCKET PROPELLANT INITIATION VIA PARTICLE BEAM HEATING
Alexander Stolovy, Arthur I. Namenson, and John M. Kidd 17 May 1990 23 p
(AD-A221900; NRL-MR-6646) Avail: NTIS HC A03/MF A01 CSCL 21/9

The thermal initiation thresholds and explosion temperatures for two solid propellants with ammonium perchlorate (AP) as their major ingredient, and three solid propellants containing HMX, AP, NG and Al powder were measured. The samples were confined and heated uniformly to explosion with beams of high energy electrons or protons. Thermal thresholds for the AP-based propellants were found to be about twice those for the second

group of propellants, where the most thermally sensitive ingredient is probably NG (nitroglycerine). GRA

N90-26897# Johns Hopkins Univ., Laurel, MD. Applied Physics Lab.
RAMJET AND RAMROCKET PROPULSION SYSTEMS FOR MISSILES Abstract Only
Frederick S. Billig *In* Sandia National Labs., Summary of Discussions at the Eleventh Meeting of the Sandia Cooperative Group on the Aerothermochemistry of Turbulent Combustion Oct. 1988 p 9 (For primary document see N90-26896 21-25)
Avail: NTIS HC A03/MF A01

N90-27293*# Rockwell International Corp., Canoga Park, CA. Rocketdyne Div.
A HYBRID APPROACH TO SPACE POWER CONTROL
E. W. Gholdston, D. F. Janik, and K. A. Newton *In* NASA, Marshall Space Flight Center, Fifth Conference on Artificial Intelligence for Space Applications May 1990 p 155-163 (For primary document see N90-27275 21-61)
Avail: NTIS HC A25/MF A04 CSCL 10C

23 CHEMISTRY AND MATERIALS (GENERAL)

N90-26879# Florida Univ., Gainesville. Dept. of Chemistry.
RESONANCE ENHANCED TWO-LASER INFRARED MULTIPLE PHOTON DISSOCIATION OF GASEOUS IONS Technical Report, Jan. 1989 - Feb. 1990
Clifford H. Watson, Jeffrey A. Zimmerman, James E. Bruce, and John R. Eyler 19 May 1990 27 p Submitted for publication
(Contract N00014-87-G-0248)
(AD-A221826; TR-30) Avail: NTIS HC A03/MF A01 CSCL 07/3

Ions trapped in a Fourier Transform Ion Cyclotron Resonance (FTICR) mass spectrometer exhibited enhanced Infrared Multiple Photon Dissociation (IRMPD) when irradiated sequentially by two carbon dioxide lasers using a novel IRMPD probe/pump photodissociation scheme. A low power pulsed (probe) laser tuned to a resonant infrared absorption band promoted trapped ions to vibrationally excited states, but had insufficient energy to cause photodissociation. Subsequent irradiation of the excited ions with a fixed frequency, nonresonant, continuous wave (pump) laser induced photofragmentation. Photodissociation spectra were obtained by varying the wavelength of the probe laser. A novel White-type cell which dramatically enhances the effect of the probe laser was designed and constructed for use with these experiments. GRA

24 COMPOSITE MATERIALS

Includes physical, chemical, and mechanical properties of laminates and other composite materials.
For ceramic materials see *27 Nonmetallic Materials.*

N90-26880*# National Aeronautics and Space Administration. Pasadena Office, CA.
NEW CORE DESIGN FOR USE WITH PRECISION COMPOSITE REFLECTORS Patent Application
Christopher C. Porter, inventor (to NASA), Paul J. Jacoy, inventor (to NASA), and Wesley P. Schmitigal, inventor (to NASA) (Jet Propulsion Lab., California Inst. of Tech., Pasadena.) 30 Mar. 1990 21 p
(Contract NAS7-918)
(NASA-Case-NPO-17858-1-CU; NAS 1.71:NPO-17858-1-CU; US-Patent-Appl-SN-503487) Avail: NTIS HC A03/MF A01 CSCL 11D

A uniformly flexible core, and method for manufacturing the same, is disclosed for use between the face plates of a sandwich structure. The core is made of a plurality of thin corrugated strips, the corrugations being defined by a plurality of peaks and valleys connected to one another by a plurality of diagonal risers. The corrugated strips are orthogonally criss-crossed to form the core. The core is particularly suitable for use with high accuracy spherically curved sandwich structures because undesirable stresses in the curved face plates are minimized due to the uniform flexibility characteristics of the core in both the X and Y directions. The core is self venting because of the open geometry of the corrugations. The core can be made from any suitable composite, metal, or polymer. Thermal expansion problems in sandwich structures may be minimized by making the core from the same composite materials that are selected in the manufacture of the curved face plates because of their low coefficients of thermal expansion. Where the strips are made of a composite material, the core may be constructed by first cutting an already cured corrugated sheet into a plurality of corrugated strips and then secondarily bonding the strips to one another or, alternatively, by lying a plurality of uncured strips orthogonally over one another in a suitable jig and then curing and bonding the entire plurality of strips to one another in a single operation. NASA

N90-26881*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
A TOUGH HIGH PERFORMANCE COMPOSITE MATRIX Patent Application
Ruth H. Pater, inventor (to NASA) and Norman J. Johnston, inventor (to NASA) 31 Oct. 1989 29 p
(NASA-Case-LAR-14338-1; NAS 1.71:LAR-14338-1; US-Patent-Appl-SN-429514) Avail: NTIS HC A03/MF A01 CSCL 11D

This invention is a semi-interpenetrating polymer network which includes a high performance thermosetting polyimide having a nadic end group acting as a crosslinking site and a high performance linear thermoplastic polyimide. Provided is an improved high temperature matrix resin which is capable of performing in the 200 to 300 C range. This resin has significantly improved toughness and microcracking resistance, excellent processability, mechanical performance and moisture and solvent resistances. NASA

N90-26882# Argonne National Lab., IL. Materials Science Div.
A STUDY OF THE ELASTIC PROPERTIES OF Al2O3 AND Si3N4 MATRIX COMPOSITES WITH SiC WHISKER REINFORCEMENT
E. S. Fisher, M. H. Manghnani (Hawaii Univ., Honolulu.), and J. L. Routbort May 1990 11 p Presented at the TMS Symposium on High Performance Composites for the 1990's, Morristown, NJ, 6-8 Jun. 1990
(Contract W-31-109-eng-38)
(DE90-013674; CONF-9006227-1) Avail: NTIS HC A03/MF A01

A study of the elastic moduli of Al2O3 and Si3N4 ceramics reinforced with 0-25 wt percent SiC whiskers was carried out. The Young's and shear moduli for each composite sample are compared with upper and lower bounds as calculated from the elastic moduli of the constituents using Paul's model. The moduli for the Al2O3 based composites are generally lower than the calculated lower bounds whereas the values for the Si3N4 based composites are in agreement with the average between the upper and lower bounds. These results are interpreted as reflecting the relatively poor Al2O3/SiC interface bond, which allows for the observed whisker pullout in these samples, and the relatively strong interface bond in the Si3N4 composites. DOE

N90-26883# Oak Ridge National Lab., TN.
HIGH TEMPERATURE STRENGTH OF SiC WHISKER-REINFORCED SILICON NITRIDE COMPOSITES
T. N. Tiegs, P. F. Becher, M. K. Ferber, and P. A. Menchhofer 1990 6 p Presented at the 7th World Ceramics Congress: Ceramics Today/Tomorrow's Ceramics, Montecatini Terme, Italy, 24-30 Jun. 1990
(Contract DE-AC05-84OR-21400)
(DE90-013822; CONF-900634-4) Avail: NTIS HC A02/MF A01

The addition of SiC whiskers to Si3N4 based matrices results in improved flexural strength and fracture toughness at room temperature; however, at temperatures greater than 1000 C, the strength can be lower than that of the monolithic material. This effect is a function of the impurity content introduced by the whiskers and the affect of such impurities on the composition of the intergranular glass phase. Other factors affecting the high-temperature strength are whisker type and content. DOE

N90-26884# National Aerospace Lab., Tokyo (Japan).
STUDY ON FAILURE MODES OF SiC FIBER REINFORCED ALUMINUM COMPOSITE MATERIALS BY AE METHOD
Yasushi Sofue and Akinori Ogawa Aug. 1989 16 p In JAPANESE
(DE90-505518; NAL-TM-612) Avail: NTIS (US Sales Only) HC A03/MF A01

The failures of SiC fiber reinforced aluminum composite materials were tested with four types of specimens, and acoustic emission (AE) characteristics in different failure modes were discussed examining such AE generation behavior as numbers, locations and amplitude distributions in a range from lower load to breaking load. Fracture conditions were also observed by a scanning electron microscope to examine the relation between fractures and AE characteristics. As a result, in the unidirectionally reinforced specimen, fiber breakage, delamination and matrix damage were developed over a wide range, and in the 0/90 degree laminated specimen, delamination and matrix damage were developed in the mid section of 90 degree fiber layers and the same failures as the unidirectional one in 0 degree fiber layers. In the plus or minus 45 degree laminated specimen, large elongation was developed due to the slip between fibers and matrix, and in the specimen with grooves on both sides, delamination was developed. The breaking stresses of the specimens were 1544, 656, 193, 47MPa, respectively. DOE

N90-26885# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Engineering Science and Mechanics.
ROLE OF INTERFACES AND INTERPHASES IN THE EVOLUTION MECHANICS OF MATERIAL SYSTEMS Annual Report, 1 Dec. 1988 - 1 Dec. 1989
K. L. Reifsnider, W. W. Stinchcomb, D. Dillard, R. E. Swain, J. Lesko, and K. Jayarman 31 Dec. 1989 34 p
(Grant AF-AFOSR-0216-89; AF Proj. 2302)
(AD-A222702; AFOSR-90-0563TR) Avail: NTIS HC A03/MF A01 CSCL 11/4

The general objective of this investigation is to apply the discipline of mechanics to the prediction and description of the long-term behavior of composite materials by developing experimental information, conceptual understanding, and analytical representations of the evolution of the properties of constituent materials and interfaces in composite material systems as a function of (generalized) time during the application of time-variable mechanical, thermal, and chemical loadings. The general approach to this objective is to develop mechanistic representations of the state of the material under those conditions, and to join those descriptions with micromechanical descriptions of the state of stress in critical elements to support an estimate of remaining strength, and, thereby, to predict remaining life. This enterprise was named evolution mechanics. GRA

N90-26886# Gordon Research Conferences, Inc., Kingston, RI.
THE 1990 GORDON RESEARCH CONFERENCE ON COMPOSITES Final Report, 1 Nov. 1989 - 31 Oct. 1990
A. T. DiBenedetto Apr. 1990 12 p Conference held in Ventura, CA, 2-6 Jan. 1990
(Contract DAAL03-90-G-0013; DA Proj. 1L1-61102-BH-57)
(AD-A222849; ARO-27521.1-MS-CF) Avail: NTIS HC A03/MF A01 CSCL 11/4

With the assistance of funding from the Army Research Office we were able to attract outstanding speakers and discussion leaders from academe, industry and government. The program started with two presentations on the chemistry of organic high temperature matrices for composites which were followed later in the week by two presentations on the selection and behavior of ceramic matrices and composites. A unique aspect of this conference was a strong emphasis on methods for characterizing composites through presentations on stereoimaging, tunneling microscopy and a variety of spectroscopic techniques. The bulk of the conference dealt with fracture, toughening and lifetime prediction over a range of composites from the traditional fiber reinforced materials to micro and molecular composites. A final pair of presentations on process engineering and analysis completed our broad range of coverage on the chemistry, physics and engineering of composite materials. GRA

N90-26887# Army Materials Technology Lab., Watertown, MA. Polymer Research Branch.
APPLICATIONS OF DIGITAL IMAGE PROCESSING IN TESTING AND EVALUATION OF COMPOSITE MATERIALS Final Report
Gary L. Hagnauer, James D. Kleinmeyer, John J. Wixted, and John H. Grubbs (Military Academy, West Point, NY.) May 1990 21 p
(DA Proj. 1L1-62105-AH-84)
(AD-A222939; MTL-TR-90-24) Avail: NTIS HC A03/MF A01 CSCL 11/4

This report describes the development and application of digital image processing techniques for analyzing the fracture behavior and environmental deterioration of test specimens prepared from composite laminate materials used in the manufacture of helicopter rotor blades. The digitized images were evaluated using pixel histograms generated through routines developed on a C-interpreter. Laminate fiber orientation and aging conditions were found to have a significant effect on the observed fracture patterns and surface characteristics of the test specimens. Pixel histograms of environmentally aged test specimens were broader and shifted to higher grey level values compared to histograms of the unaged specimens. Under the test procedures developed, digital image analysis results were reproducible and fiber orientation did not significantly affect the average grey level of either aged or unaged specimens. GRA

N90-26888# University of Southern California, Los Angeles.
CORROSION PROTECTION OF METAL MATRIX COMPOSITES Final Report, Oct. 1986 - Apr. 1990
F. Mansfeld, S. Lin, and H. Shih 1 Apr. 1990 114 p
(Contract DAAL03-86-K-0156)
(AD-A222951; ARO-24150.4-MS-A) Avail: NTIS HC A06/MF A01 CSCL 11/4

Corrosion protection of Al alloys, Al-based metal matrix composites (MMCs), and Al-Li alloy by conversion coatings, anodized layers, polymer coatings, and chemical passivation in CeCl3 has been evaluated in a simulated marine environment (0.5 N NaCl) by electrochemical impedance spectroscopy (EIS). Conversion coatings, anodizing, polymer coatings have been evaluated for MgAZ31B. Chromate conversion coatings (Alodine 600) provided corrosion protection for Al/SiC and Al/Gr MMCs, but were not as effective as for Al 6061. For Al/SiC it was observed that sulfuric acid anodizing did not produce the corrosion resistance obtained for the Al 6061. The corrosion resistance for hard anodized Al/SiC was less than that for conventional anodized Al/SiC. GRA

N90-26889# University of Southern California, Los Angeles. Hydrocarbon Research Inst.
COMPOSITE MATERIALS WITH IMPROVED PROPERTIES IN COMPRESSION. APPENDIX 1: CYCLOPROPANATION OF POLY(1-METHYL 1-PHENYL 1-SILA-CIS-PENT-3-ENE). SYNTHESIS AND CHARACTERIZATION OF POLY(1-METHYL 3,4-METHYLENE-1-PHENYL 1-SILA-CIS-PENT-3-ENE) Interim Report
Xiugao Liao, Howard S. Lee, and William P. Weber 9 May 1990 16 p
(Contract N00014-89-J-1961; AF-AFOSR-0007-89)
(AD-A221494) Avail: NTIS HC A03/MF A01 CSCL 11/4

There is considerable interest in the chemical modification of

polymers. While it has been possible to stereo specifically quantitatively add dichlorocarbene to the C-C double bonds of 1,4-polybutadiene as well as to those of poly(1,1-dimethyl 1-sila cis-pent-3-ene) (II), it has not been possible to achieve complete cyclopropanation of the C-C double bonds of either 1,4-polybutadiene or II by use of the Simmons-Smith reaction. NMR spectra were obtained either on a Brucker AM-360 or an IBM Brucker WP-270-SY spectrometer operating in the Fourier transform mode. Five to ten percent weight/volume solutions of polymers C12C-I and H2C-I in chloroform-d were used to obtain NMR spectra, whereas ten to fifteen percent solutions were utilized for 13C and 29Si NMR spectra. BC NMR spectra were run with broad band proton decoupling. Chloroform was used as an internal standard for 1H and 13C NMR spectra. GRA

N90-26890# Aerospace Corp., El Segundo, CA. Materials Sciences Lab.
POLYARYLACETYLENE RESIN COMPOSITES
Howard A. Katzman 2 Apr. 1990 31 p
(Contract F04701-88-C-0089)
(AD-A221507; TR-0090(5935-06)-1; SSD-TR-90-013) Avail: NTIS HC A03/MF A01 CSCL 11/4

Polyarylacetylene (PAA), a highly cross-linked aromatic polymer that has a char yield of 90 percent when pyrolyzed in an inert environment, has been investigated in a major research and development program designed to realize the potential benefits of this material in space system components. The recent achievements of the Materials Sciences Laboratory in developing the processing techniques needed to fabricate carbon-fiber-reinforced PAA composites are outlined. Large, thick composites were fabricated and were demonstrated in various practical applications. Applications include dimensionally stable space system composite structures, ablative insulators for solid-rocket-motor nozzles and exit cones, and precursors for relatively low-cost carbon-carbon composites. GRA

N90-26891# Air Force Systems Command, Wright-Patterson AFB, OH. Foreign Technology Div.
A STUDY ON CARBON FIBER (LONG FIBER) REINFORCED COPPER MATRIX COMPOSITE
Yulin Wang, Zhaonian Liu, Hongxiang Zhang, and Danan Fan 30 Mar. 1990 16 p Transl. into ENGLISH from Tianjin Daxue Xuebao (Peoples Republic of China), no. 4, 1988 p 61-67
(AD-A221584; FTD-ID(RS)T-0891-89) Avail: NTIS HC A03/MF A01 CSCL 11/2

Based on the characteristics of carbon fiber, this paper describes the technology of continuous multi-step electrodeposition and a self-made special installation for continuous three-step electrodeposition. The carbon fiber (long fiber) reinforced copper matrix composites produced has a longitudinal tensile strength of 590 MPa by continuous three-step electrodeposition and vacuum hot pressing. Experiments show that this method has the following advantages: low operating temperature, easy adjustment of fiber volume fraction, uniform arrangement of fiber, ready achievement of continuous operation, low cost and high quality of carbon fiber reinforced copper composites. GRA

N90-26892# University of Southern California, Los Angeles. Hydrocarbon Research Inst.
COMPOSITE MATERIALS WITH IMPROVED PROPERTIES IN COMPRESSION: COPOLYMERIZATION OF 1,1-DIMETHYL-1-SILACYCLOPENT-3-ENE AND 1,1-DIPHENYL-1-SILACYCLOPENT-3-ENE. CHARACTERIZATION OF COPOLYMER MICROSTRUCTURES BY H1, C13, AND Si29 NMR SPECTROSCOPY Interim Report
Qingshan Zhou, Georges Manuel, and William P. Weber 1990 5 p Repr. from Macromolecules, 1990 p 23
(Contract N00014-89-J-1961; AF-AFOSR-0007-89)
(AD-A221686) Avail: NTIS HC A01/MF A01 CSCL 11/4

1,1-Dimethyl 1-silacyclopent-3-ene and 1,1-diphenyl 1-silacyclopent-3-ene were copolymerized by treatment with n-butylithium and hexamethylphosphoramide in THF at -50 C. Random copolymers are formed. The microstructures of these were characterized by 1H, 13C and 29Si NMR spectroscopy. Thermal stabilities of these copolymers were determined by thermogravimetric analysis. Their glass transition temperatures were measured by differential scanning calorimetry. GRA

N90-26893# United Technologies Research Center, East Hartford, CT.
INTERFACIAL STUDIES OF CHEMICAL VAPOR INFILTRATED (CVI) CERAMIC MATRIX COMPOSITES Final Report
J. J. Brennan 31 Mar. 1990 67 p
(Contract N00014-87-C-0699)
(AD-A221867; UTRC/R90-917779-5) Avail: NTIS HC A04/MF A01 CSCL 11/4

The objective was to investigate the fiber/matrix interfacial chemistry in CVI SiC matrix composites utilizing Nicalon SiC and Nextel 440 mullite fibers and to determine how this interface influences composite properties such as strength, toughness, and environmental stability. The SiC matrix was deposited using three different reactants: methyl dichlorosilane (MDS), methyl trichlorosilane (MTS), and dimethyldichlorosilane (DMDS). The fiber/matrix interface was tailored by means of introducing a carbon, BN, or carbon rich SiC interfacial layer. It was found that applying a carbon interfacial layer to either NICALON or Nextel 440 fibers prior to deposition of SiC resulted in a weakly bonded interface that imparted toughness to CVI matrix composite through its ability to deflect matrix cracks. This carbon layer can be applied either deliberately by the decomposition of methane or by utilizing an argon flushing gas in the reactor that apparently interrupted the normal deposition of SiC from silane precursors and instead allowed carbon to deposit. Results show that this carbon interfacial layer, no matter how deposited, was not stable oxidatively at elevated temperatures, which led to severe degradation of composite properties. GRA

N90-26894# Costruzioni Aeronautiche Giovanni Agusta S.p.A., Cascina Costa (Italy). Div. Elicotteri.
DESIGN OF HELICOPTER COMPONENTS IN METAL MATRIX COMPOSITES [CONSIDERAZIONI SULLA PROGETTAZIONE DI COMPONENTI PER ELICOTTERO IN COMPOSITI A MATRICE METALLICA]
Franco Persiani, Gian Paolo Cammarota (Bologna Univ., Italy), and Giancarlo Donzelli 16 Oct. 1989 19 p In ITALIAN
(Rept-100-20-55; ETN-90-97268) Avail: NTIS HC A03/MF A01

The general criteria to identify the components suitable to be manufactured with metal matrix composites are discussed. The technological analysis of the possible contribution of these materials to helicopter design is presented. The status of research activities in this field is discussed. ESA

N90-26895# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (Germany, F.R.). Central Labs.
MANUFACTURING AND MECHANICAL PROPERTIES OF NEW TEXTILE FIBER PREFORMS FOR STRUCTURAL SANDWICH APPLICATIONS
T. Preller, J. Brandt, and K. Drechsler 1989 12 p Presented at Un Batiment Tout Textile, Composite Materials with Textile Reinforcement for Use in Building Construction and Related Applications, Lyon, France, 16-18 Jul. 1990
(MBB-Z-0296-90-PUB; ETN-90-97349) Avail: NTIS HC A03/MF A01

Honeycomb and foam materials for sandwich structures found a wide use in aerospace applications due to their high degree of specific stiffnes. Newly developed textile fiber preforms such as integrally woven, deep-drawn knitted and braided tube materials have advantages compared to conventional sandwich materials. Textile sandwich materials can be manufactured from any material available in fiber form in conjunction with different resin systems. The manufacturing and the mechanical properties of the newly developed textile fiber materials are presented. A comparison with foam and honeycomb sandwich structures shows the potential of this new material class. ESA

N90-26811# Air Force Wright Aeronautical Labs., Wright-Patterson AFB, OH. Nondestructive Evaluation Branch.
CHARACTERIZATION OF IMPACT DAMAGE IN COMPOSITES
C. F. Buynak and T. J. Moran *In* AFWAL, Proceedings of the 1987 Aircraft/Engine Structural Integrity Program (ASIP/ENSIP) Conference Jun. 1988 p 133-152 (For primary document see N90-26807 21-05)
Avail: NTIS HC A99/MF E06 CSCL 11D

25 INORGANIC AND PHYSICAL CHEMISTRY

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also *77 Thermodynamics and Statistical Physics.*.

N90-26896# Sandia National Labs., Livermore, CA. Combustion Research Facility.
SUMMARY OF DISCUSSIONS AT THE ELEVENTH MEETING OF THE SANDIA COOPERATIVE GROUP ON THE AEROTHERMOCHEMISTRY OF TURBULENT COMBUSTION
R. W. Dibble and Robert P. Lucht Oct. 1988 48 p Meeting held in Livermore, CA, 29-30 Mar. 1988
(Contract DE-AC04-76DP-00789)
(DE89-001846; SAND-88-8257; CONF-8803165-Summ) Avail: NTIS HC A03/MF A01

Several topics related to the modeling of turbulent reacting flows and turbulent combustion are discussed. Ramjet missile propulsion, flame extinction in compressible flow, direct numerical simulation of compressible free shear flows, advanced optical diagnostics in hypersonic research, and Raman scattering measurements using ultraviolet excimer lasers are among the subjects discussed. For individual titles, see N90-26897 through N90-26909.

N90-26897# Johns Hopkins Univ., Laurel, MD. Applied Physics Lab.
RAMJET AND RAMROCKET PROPULSION SYSTEMS FOR MISSILES Abstract Only **c20**
Frederick S. Billig *In* Sandia National Labs., Summary of Discussions at the Eleventh Meeting of the Sandia Cooperative Group on the Aerothermochemistry of Turbulent Combustion Oct. 1988 p 9 (For primary document see N90-26896 21-25)
Avail: NTIS HC A03/MF A01

A terse look at the requirements for high-speed long-endurance missiles and the virtues of airbreathing propulsion is presented to support arguments for developing ramjets that employ supersonic combustion. A review of general classes of inlet configurations leads to the selection of multiple inward turning scoop (ITS) configurations to serve as the basis for engine cycle analysis. A fixed geometry ITS inlet is shown not only to have an attractive performance potential, but to be quite versatile for use in a variety of engine configurations. When it is designed to have full air capture at a flight Mach number M sub o somewhat below the cruise Mach number, it can produce high pressure recovery over a wide M sub o range with high air capture during climbout at low angle of attack alpha as well as during cruise at near optimal alpha. The geometry of a family of ITS inlets is examined to determine optimal configurations for various constraints and to provide quantitative values for the flow properties for entering the combustor analysis. A flow model for the combustion process that includes the major features that have been observed in experiments serves as the basis for determining the pressure rise in the shock train that precedes combustion and the conditions at the combustor exit. Calculations for simplified frictionless flow with constant specific heats show that: (1) the combustor area ratio is set by the acceleration requirements at the end of boost; (2) the combustor operates in a subsonic mode at low M sub o and in a supersonic mode at high M sub o, and (3) optimal performance occurs when the combustor inlet conditions correspond to moderate inlet contractions ratios. Computer values for the net engine force coefficient show that forebody drag must also be considered to determine the optimal overall engine configuration.
Author

N90-26898*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
MODELING OF SUPERSONIC REACTING FLOW FIELDS **c07**
J. P. Drummond and H. S. Mukunda *In* Sandia National Labs., Summary of Discussions at the Eleventh Meeting of the Sandia Cooperative Group on the Aerothermochemistry of Turbulent Combustion Oct. 1988 p 10-20 (For primary document see N90-26896 21-25)
Avail: NTIS HC A03/MF A01 CSCL 21E

A detailed understanding of the scramjet combustor flow field is critical to the achievement of a successful design. Even though the combustor flow field is quite complex, it can be realistically viewed as a collection of spatially developing and reacting supersonic mixing layers that are initially discrete, but that ultimately merge into larger more complex zones. These mixing layers begin downstream of a set of fuel injectors that introduce gaseous hydrogen in both a parallel and transverse direction into a supersonic air stream entering from the engine inlet. The behavior of the initial portion of the combustor flow, in the mixing layers near the fuel injectors, appears to be most critical, since this is where the mechanism for efficient high speed mixing must be established to achieve the required degree of combustion downstream. Because of the structure of the flow field in this initial portion of the combustor, a single supersonic, spatially developing and reacting mixing layer serves as an excellent physical model for the overall flow field. Even though this reacting mixing layer flow is geometrically simple, it can still be made to retain all of the fluid mechanical and chemical complexities present in the actual combustor flow field.
Author

N90-26899# General Electric Co., Schenectady, NY. Corporate Research and Development Center.
FLAME EXTINCTION IN COMPRESSIBLE FLOW Abstract Only **c34**
S. M. Correa *In* Sandia National Labs., Summary of Discussions at the Eleventh Meeting of the Sandia Cooperative Group on the Aerothermochemistry of Turbulent Combustion Oct. 1988 p 21 (For primary document see N90-26896 21-25)
Avail: NTIS HC A03/MF A01

The structure of the compressible stagnation flow at the forward point of a cylinder in a uniform stream is examined. Such flows are used in the laboratory to characterize the structure and stability limits of counterflow diffusion flames, where the fuel is emitted radially from the surface of the cylinder against the uniform approach flow. While hydrocarbon fuels are extinguished at relatively low strain rates, corresponding to low approach velocities, hydrogen requires much larger strain rates for extinction. The corresponding approach flow is in the compressible range and requires analysis as such. Solutions and estimates are developed for the cases of subsonic and supersonic flow. In particular, a Rayleigh-Janzen expansion of the potential function is carried out to six terms, using a symbolic manipulation language, and the analytical results are differentiated to obtain the strain field in subsonic flow. Compressibility is shown to decrease the strain rate for constant approach velocity and cylinder radius. This counter-intuitive result is shown to be a near-field phenomenon due to higher-order singularities; the strain further upstream is shown to increase. Estimates made for the case of supersonic flow indicate a lower level of strain compared with that in subsonic compressible flow. These results indicate that compressibility of the free stream offers a potential for increased flame stability. The conclusions are relevant to flame stability in high-speed combustors, such as those in supersonic combustion ramjets.
Author

N90-26900# Stanford Univ., CA. High Temperature Gasdynamics Lab.

DEVELOPMENT OF PLANAR LASER-INDUCED FLUORESCENCE (PLIF) TECHNIQUES FOR SUPERSONIC FLOWS Abstract Only **c34**

Ronald K. Hanson *In* Sandia National Labs., Summary of Discussions at the Eleventh Meeting of the Sandia Cooperative Group on the Aerothermochemistry of Turbulent Combustion Oct. 1988 p 22 (For primary document see N90-26896 21-25)
Avail: NTIS HC A03/MF A01

Research to develop 2-d flowfield imaging techniques based on planar variations of laser-induced fluorescence is reported. The presentation includes discussion of: fluorescence models and excitation/detection strategies; progress in developing intensified CCD cameras; and example results obtained in various combusting and nonreacting supersonic flows. Representative planar laser-induced fluorescence (PLIF) images of OH obtained in a small-scale supersonic H2-air combustor are shown. The data was obtained in the central vertical plane of a supersonic jet of H2 mixing in slow-flowing, fuel-lean methane-air combustion products. The field imaged is approximately 3 cm x 4 cm, and the resolution is 240 x 512 pixels. The results illustrate the dramatic difference between time-averaged and instantaneous flame contours.
Author

N90-26901*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.

DIRECT NUMERICAL SIMULATION OF COMPRESSIBLE FREE SHEAR FLOWS Abstract Only **c34**

Sanjiva K. Lele *In* Sandia National Labs., Summary of Discussions at the Eleventh Meeting of the Sandia Cooperative Group on the Aerothermochemistry of Turbulent Combustion Oct. 1988 p 23 Previously announced in IAA as A89-25317 (For primary document see N90-26896 21-25)
Avail: NTIS HC A03/MF A01 CSCL 20D

Direct numerical simulations of compressible free shear layers in open domains are conducted. Compact finite-difference schemes of spectral-like accuracy are used for the simulations. Both temporally-growing and spatially-growing mixing layers are studied. The effect of intrinsic compressibility on the evolution of vortices is studied. The use of convective Mach number is validated. Details of vortex roll up and pairing are studied. A simple explanation of the stabilizing effect of compressibility is offered. Acoustic radiation from vortex roll up, pairing and shape oscillations is studied and quantified.
Author

N90-26902# Vanderbilt Univ., Nashville, TN. Dept. of Mechanical and Materials Engineering.

RAMAN SCATTERING MEASUREMENTS USING UV EXCIMER LASERS

Robert W. Pitz, Joseph A. Wehrmeyer, and John M. Bowling *In* Sandia National Labs., Summary of Discussions at the Eleventh Meeting of the Sandia Cooperative Group on the Aerothermochemistry of Turbulent Combustion Oct. 1988 p 24-33 (For primary document see N90-26896 21-25)
Avail: NTIS HC A03/MF A01

Efficient mixing and combustion are critical issues for practical supersonic combustion. Due to the lack of data in supersonic combustion, little is known about these basic processes in prototype supersonic combustors. Finite-rate chemistry effects are particularly important. Finite-rate chemistry in a supersonic combustor can affect the thrust (from slow radical recombination), shock positions (through changes in the ratio of specific heats) and the combustion efficiency (from flame extinction effects). Vibrational Raman scattering (VRS) has been used extensively in subsonic hydrogen-fueled flames to obtain time-and-space resolved measurements of flow properties. The advantage of the VRS probe is that all the major species (H2, H2O, O2, and N2), temperature, density, and pressure can be determined simultaneously. Each of the molecular species produces a Raman spectrum at a unique wavelength and the signal related to the flow properties. Since the Raman probe measures all the reactants, products, and temperature, finite-rate chemistry effects can be determined. As discussed here, recently developed excimer lasers that operate at UV wavelengths can substantially enhance VRS probes for turbulent supersonic combustion measurement. The ultimate aim of this UV Raman work is to: (1) Develop a UV Raman probe with improved performance over conventional visible laser systems; (2) Apply the VRS probe to a well defined supersonic combustor such as a co-flowing, axisymmetric turbulent hydrogen jet diffusion flame; and (3) Quantify the effects of finite-rate chemistry and compressibility in a supersonic turbulent flame. Efforts to attain the first goal are described.
Author

N90-26903*# Vanderbilt Univ., Nashville, TN. Dept. of Mechanical Engineering.

CONCENTRATION, TEMPERATURE, AND DENSITY IN A HYDROGEN-AIR FLAME BY EXCIMER-INDUCED RAMAN SCATTERING

Joseph A. Wehrmeyer, John M. Bowling, and Robert W. Pitz *In* Sandia National Labs., Summary of Discussions at the Eleventh Meeting of the Sandia Cooperative Group on the Aerothermochemistry of Turbulent Combustion Oct. 1988 p 34-40 (For primary document see N90-26896 21-25)
(Grant NAG1-770)
Avail: NTIS HC A03/MF A01 CSCL 21B

Single-pulse, vibrational Raman scattering (VRS) is an attractive laser diagnostic for the study of supersonic hydrogen-air combustion. The VRS technique gives a complete thermodynamic description of the gas mixture at a point in the reacting flow. Single-pulse, vibrational Raman scattering can simultaneously provide independent measurements of density, temperature, and concentration of each major species (H2, H2O, O2 and N2) in a hydrogen/air turbulent combustor. Also the pressure can be calculated using the ideal gas law. However, single-pulse VRS systems in current use for measurement of turbulent combustion have a number of shortcomings when applied to supersonic flows: (1) slow repetition rate (1 to 5 Hz), (2) poor spatial resolution (0.5x0.3x0.3 cu mm), and (3) marginal time resolution. Most of these shortcomings are due to the use of visible wavelength flash-lamp pumped dye lasers. The advent of UV excimer laser allows the possibility of dramatic improvements in the single-pulse, vibrational Raman scattering. The excimer based VRS probe will greatly improve repetition rate (100 to 500 Hz), spatial resolution (0.1x0.1x0.1 cu mm) and time resolution (30ns). These improvements result from the lower divergence of the UV excimer, higher repetition rate, and the increased Raman cross-sections (15 to 20 times higher) at ultra-violet (UV) wavelengths. With this increased capability, single-pulse vibrational Raman scattering promises to be an ideal non-intrusive probe for the study of hypersonic propulsion flows.
Author

N90-26904# Sandia National Labs., Livermore, CA. Combustion Research Facility.

A LINEAR-EDDY MODEL OF TURBULENT SHEAR LAYER MIXING Abstract Only **c34**

Alan R. Kerstein *In its* Summary of Discussions at the Eleventh Meeting of the Sandia Cooperative Group on the Aerothermochemistry of Turbulent Combustion Oct. 1988 p 41 (For primary document see N90-26896 21-25)
Avail: NTIS HC A03/MF A01

Recent experimental studies of turbulent shear layer mixing indicate that the mixing rate, suitably normalized, is a decreasing function of Reynolds and Schmidt number, possibly depending only on Pe=Sc Re over a wide range of Sc values. Also, the concentration at which the concentration field probability distribution function (pdf) peaks is found to be independent of spatial location. Here, a simple stochastic mixing model has been found to reproduce both the measured parameter dependences of the mixing rate and the qualitative features concentration pdf. Furthermore, the model reconciles the observed differences between planar shear layer mixing and the thermal mixing layer in grid turbulence without postulating any fundamental differences between the respective mixing processes. The computational model is based on the linear-eddy approach, which the author recently introduced as a means of modeling scalar transport in

configurations for which a broad range of length scales must be resolved. The approach involves the representation of a spatially developing flow by stochastic simulation of the temporal evolution along a transverse line moving with the mean flow. The limitation to one spatial dimension allows resolution of all relevant length scales for Reynolds numbers of practical interest. The present application involves computations for Re of order 10,000, comparable to experimental conditions. Author

N90-26905# Sandia National Labs., Livermore, CA. Combustion Research Facility.

ADVANCED OPTICAL DIAGNOSTICS IN HYPERSONIC RESEARCH Abstract Only **c74**

Robert J. Cattolica *In its* Summary of Discussions at the Eleventh Meeting of the Sandia Cooperative Group on the Aerothermochemistry of Turbulent Combustion Oct. 1988 p 42 (For primary document see N90-26896 21-25)
Avail: NTIS HC A03/MF A01

The renewed emphasis on hypersonic research has stimulated a resurgence of interest in experimental methods for the study of high-speed flows. Improvement in the physical and chemical models used in computational fluid dynamic simulation of hypersonic flows requires a modern experimental data base. Optical diagnostics provide the capability to make nonintrusive measurements of density, temperature, velocity, and species concentration in hypersonic flows. The short test time available in hypersonic wind tunnels or flight experiments necessitates spectroscopic methods capable of producing high signal levels. Fluorescence methods based on laser or electron-beam excitation satisfy this requirement. For flight experiments, electron-beam excitation offers a number of advantages over laser excitation that include small device size, high electrical efficiency, and multiple-state and species-selective excitation. Disadvantages of the electron beam fluorescence (EBF) technique included a complex excitation mechanism and some limitations in high-density applications. Laser fluorescence methods (LIF) have been developed extensively in recent years for combustion research, but need further advances in miniaturization of lasers for application to in-flight hypersonic combustion and aerodynamic experiments. Both techniques require a fundamental understanding of the complications introduced by physical effects such as energy transfer and quenching of the fluorescence signal. With modern electro-optic instrumentation it is now possible to examine in detail the influence of these phenomena on EBF and LIF fluorescence spectra in the laboratory and to extend these measurement techniques for use in flight research. To illustrate some of the research required to develop these methods to address issues relevent to hypersonic flight, examples of experiments on the use of EBF and LIF spectroscopy for the measurement of nitric oxide concentration are presented. Author

N90-26906# Sydney Univ. (Australia).

FOUR-STEP KINETICS FOR METHANE AND IMPLICATIONS FOR TURBULENT COMBUSTION Abstract Only

R. W. Bilger *In* Sandia National Labs., Summary of Discussions at the Eleventh Meeting of the Sandia Cooperative Group on the Aerothermochemistry of Turbulent Combustion Oct. 1988 p 43 (For primary document see N90-26896 21-25)
Avail: NTIS HC A03/MF A01

A four-step reduced mechanism for methane, similar to that of Peters, has been developed. It has steady state relationships for O atom and methyl radical which are quite different from those used by Peters for rich mixtures. It gives excellent predictions for the structure and extinction of counterflow diffusion flames of methane over the whole range of flame stretch from a = 2 to 300 s-1, where a = 2V/R, V = approach air velocity, R = cylinder radius. These counterflow laminar flames are found to have a reaction zone which remains broad in mixture fraction terms over this full range of stretch. In turbulent flames the criterion for flamelet concepts to be valid is that the reaction zone thickness be small compared with the Kolmogoroff length scale of the turbulence. This can be redefined in terms of the conserved scalar or mixture fraction. It is found that most turbulent non-premixed flames violate the flamelet existence criterion except close to the jet nozzle. Distributed reaction zones result. For hydrogen/air flames at high Damkohler number the distributed zone structure can be determined directly from measurements or numerical simulations that give the mixing field in terms of the conserved scalar and its dissipation. The structure varies from being flamelet-like centered on the stoichiometric isopleth to mimicking the scalar dissipation field. Author

N90-26907# General Electric Co., Schenectady, NY. Corporate Research and Development Center.

NON-PREMIXED TURBULENT CO/H2 FLAMES AT LOCAL EXTINCTION CONDITIONS Abstract Only

S. M. Correa and A. Gulati *In* Sandia National Labs., Summary of Discussions at the Eleventh Meeting of the Sandia Cooperative Group on the Aerothermochemistry of Turbulent Combustion Oct. 1988 p 44 (For primary document see N90-26896 21-25)
Avail: NTIS HC A03/MF A01

The physical phenomena responsible for the local extinction of diffusion flames due to intense turbulence are discussed and a computational model for a jet flame under such conditions is presented. In the model, combustion chemistry is represented by two-body shuffle reactions, taken to be infinitely fast or frozen, and three-body recombination reactions. The scalar dissipation field is examined for critical values below which the two-body reactions are assumed to be in partial equilibrium and above which they are assumed to be frozen and the gas therefore unburned. The kinetics of the recombination reactions are activated for the former fraction of the gas. Implementation of this approach in a shear-layer finite-volume averaged Navier-Stokes model with k-sigma/assumed shape pdf sub-models for turbulence is presented. The model is applied to a Re = 15,000 pilot-stabilized CO/H2/N2 jet flame for which laser-based spectroscopic data on major species and temperature are presented. The model is shown to be useful for moderate to high Reynolds number diffusion flames. The fuel is chosen to maximize the probability of local extinction. Author

N90-26908# Sandia National Labs., Livermore, CA. Combustion Research Facility.

PDF MODELING OF CHEMICAL NONEQUILIBRIUM EFFECTS IN TURBULENT NONPREMIXED JET FLAMES

J.-Y. Chen and W. Kollmann *In its* Summary of Discussions at the Eleventh Meeting of the Sandia Cooperative Group on the Aerothermochemistry of Turbulent Combustion Oct. 1988 p 45 (For primary document see N90-26896 21-25)
Avail: NTIS HC A03/MF A01

A probability density function (PDF) modeling method with simplified chemical sub-models has been developed to study nonequilibrium chemical effects in turbulent non-premixed jet flames. One of the major difficulties in modeling chemical kinetics for turbulent flows with traditional moment methods is the well-known closure problem for mean chemical source terms. A commonly used approach to overcome this problem is to assume an analytical function form for the joint PDF among the scalars, and to compute the mean chemical source terms by integrating over the allowable domain. The obvious shortcoming of this method is that it is difficult, often impossible, to prescribe a certain analytical function for the joint PDF. An alternative approach is to model the joint PDF directly as suggested by Pope. The most salient feature of this method is that in the mean transport equation for the joint PDF, the effects of chemical reaction do not require modeling. The disadvantages of this approach are that modeling of molecular mixing is required and that numerical solutions of the modeled joint PDF transport equation for more than two scalars can only be obtained efficiently by the Monte Carlo simulations. This technique requires an explicit finite difference representation of the equation, and a large number of notional particles to represent the statistics accurately. In principle, the scalar changes due to chemical reactions could be calculated exactly according to the rate equations; however, the computation would be a formidable task. A typical comparison of results from two plausible models for H2-air combustion, one with a partial equilibrium assumption and another with a steady state assumption, is shown. Studies of these models have led to the following conclusions:

(1) temperature is not a sensitive parameter for model evaluation, (2) radical species, especially the H atom, are useful in identifying unrealistic results, (3) models with a partial equilibrium assumption are incapable of predicting flame extinction, (4) the H atom should be treated by its rate equation in order to capture important combustion processes, such as ignition delay and extinction.
Author

N90-26909# Sandia National Labs., Livermore, CA. Combustion Research Facility.
SCALAR DISSIPATION MEASUREMENTS IN THE DEVELOPING REGION OF A JET
M. Namazian, R. W. Schefer, and J. Kelly (Altex Technologies Corp., Los Gatos, CA.) *In its* Summary of Discussions at the Eleventh Meeting of the Sandia Cooperative Group on the Aerothermochemistry of Turbulent Combustion Oct. 1988 p 47-51 Previously announced in IAA as A89-15038 (For primary document see N90-26896 21-25)
Avail: NTIS HC A03/MF A01

Using instantaneous planar images of CH4 mass fraction in the developing region of an isothermal jet flow, the instantaneous, mean, rms, pdf, and correlations of scalar dissipation and a scalar were calculated. The mass fraction images were derived form CH4 concentrations which were obtained by simultaneously recording Raman-scattered light with two cameras oriented perpendicular to a thin sheet of laser light passed through the axis of the jet. The pdf of dissipation on the axis, off-axis, and at the stoichiometric surface were all found to be lognormally distributed. This characteristic allowed the collapse of all pdf values onto one point. The values of the parameters which define the single plot, lognormal pdf mean, and standard deviation are presented and can be used as inputs for turbulent combustion models. The data obtained support the hypothesis that excessive dissipation can extinguish flames in the developing region of jets.
Author

N90-26910# Swedish Inst. for Materials Testing, Boras. Div. of Fire Technology.
THE COMPUTER MODELING OF THE COMBUSTION AND EXTINCTION OF METHANE-AIR PREMIXED FLAMES BY THERMALLY STABLE GASES
Heimo Tuovinen 1989 76 p Sponsored by Swedish Fire Research Board
(PB90-189432; SP-RAPP-1989:54) Avail: NTIS HC A05/MF A01 CSCL 21B

A computer model was developed to examine the chemical kinetic reaction mechanism for the combustion and extinction of premixed methane-air flames. The model contains 23 chemical species and 73 elementary reaction steps. The thermal extinction theory was investigated. The radiation heat losses and the residence times of involved species in flames can be simulated with the model. The radiation term is assumed to arise only from gaseous CO2 and H2O. Extinction of the flames was simulated using four thermally stable inert gases; carbon dioxide (CO2), gaseous water (H2O), nitrogen (N2) and helium (He). According to the results obtained, the extinguishing efficiency is proportional to the molar heat capacity of the inert gas.
Author

N90-26911*# Pennsylvania State Univ., University Park. Dept. of Mechanical Engineering.
IGNITION AND COMBUSTION CHARACTERISTICS OF METALLIZED PROPELLANTS Semiannual Report, Jan. - Jun. 1990
S. R. Turns, D. C. Mueller, and M. J. Scott Jul. 1990 41 p
(Grant NAG3-1044)
(NASA-CR-186870; NAS 1.26:186870) Avail: NTIS HC A03/MF A01 CSCL 21B

Shakedown and calibration of the experimental apparatus designed to study secondary atomization and ignition characteristics of aluminum slurry propellants was begun and nears completion. The burner was tested over an array of equivalence ratios and oxygen mass fractions to determine the permissible range of operating conditions. A burner flow control system was designed and fabricated which permits independent control of flame stoichiometry and oxidant O2 concentrations. The Sun slurry formulation was selected as the base for initial testing. Laser beam waists at the focal volume of the single particle sizing system were determined to be 396 microns for the Ar-ion and 81 microns for the He-Ne laser. Size calibrations using pinholes were completed and compared to Mie theory for light scattering from particles. A vibrating office droplet generator was used to test the single particle sizing system dynamically by producing a water droplet laden gas flow. The data acquisition and analysis programming was completed and testing is in progress. From initial results, the particle sizing, atomization and ignition detection systems appear to be performing as expected.
Author

N90-26912# Los Alamos National Lab., NM. Geology and Geochemistry Div.
ILMENITE EXSOLUTION SCHEMES IN APOLLO-17 HIGH-TI BASALTS
D. Vaniman, G. Heiken, and T. Muhich (Saint Thomas Coll., Saint Paul, MN.) 1990 24 p Presented at the 21st Lunar and Planetary Science Conference, Houston, TX, Mar. 1990
(Contract W-7405-eng-36)
(DE90-011992; LA-UR-90-1897; CONF-9003166-1) Avail: NTIS HC A03/MF A01

Combined electron microprobe and scanning electron microscope (SEM) x ray image analyses are used to obtain semiquantitative data on the relations between ilmenite grains and their exsolved chromite and rutile. Comparisons of these data for ilmenites in four Apollo-17 high-Ti basalts with a database of electron microprobe analyses from the literature indicates that Cr expulsion from ilmenite can be as important as Fe(2+) reduction in causing subsolidus exsolution of chromite and rutile from ilmenite.
DOE

N90-26913# Wisconsin Univ., Madison. Dept. of Mechanical Engineering.
A THEORETICAL STUDY OF FLOW STRUCTURE AND RADIATION FOR MULTIPHASE TURBULENT DIFFUSION FLAMES Technical Report, 15 Mar. 1989 - 1 Mar. 1990
S. H. Chan and C. F. Chern 1 Mar. 1990 63 p
(Contract N00014-89-J-1267)
(AD-A222934) Avail: NTIS HC A04/MF A01 CSCL 21/2

The present technical report summarizes the progress made in considering thermal radiation in the analysis of multiphase turbulent flow structure of a halogen gas jet reacts with a liquid metal. The reaction of a halogen gas jet submerged in an alkali liquid metal fuel forms a complex diffusion flame. The flame is turbulent and multiphase in nature and its temperature is relatively high. The purpose of this study is to account for thermal radiation and the radiation/turbulent interaction in analyzing such a diffusion flame structure. A method is hereby proposed to consider the turbulence-radiation interaction in the analysis of a multiphase diffusion flame. Application is made to study the reaction of a halogen gas jet submerged in a alkali liquid fuel bath. The analysis makes use of a k-epsilon-g turbulence model, a local homogeneous two-phase model, a chemical equilibrium combustion model, a probabilistic approach and a radiation model compatible with mixture fraction fluctuation. The equilibrium state relationships for instantaneous properties, required for mean scalar property predictions and structure analysis of the reacting jet, have been generated. The energy equation containing the radiative source term has been solved simultaneously with the FAvre-averaged transport equations.
GRA

N90-26914# Massachusetts Inst. of Tech., Cambridge. Dept. of Chemistry.
THE SYNTHESIS AND STRUCTURE OF STIBAINDOLES
Stephen L. Buchwald, Richard A. Fisher, and Bruce M. Foxman 6 Jun. 1990 8 p Submitted for publication
(Contract N00014-88-K-0307)
(AD-A222990) Avail: NTIS HC A02/MF A01 CSCL 07/3

Recent applications of main group organometallic compounds in the materials sciences has dramatically increased the interest

in developing new and more selective synthetic routes to main group organometallic compounds. The first synthesis and structural characterization of a new class of metalloid-heterocycle, stibaindoles, has been accomplished by the application of a transmetallation strategy from zirconium. The facile formation, and ready isolation, of these new compounds bodes well for the role early transition metal complexes may play in the discovery of new and valuable classes of main group compounds. GRA

N90-26915# Dalhousie Univ., Halifax (Nova Scotia). Dept. of Physics.
FIELD-INDUCED SURFACE CHEMISTRY OF NO Interim Report No. 2, Feb. - Jun. 1990
H. J. Kreuzer and L. C. Wang 25 May 1990 20 p Submitted for publication
(Contract N00014-80-J-1796)
(AD-A223007) Avail: NTIS HC A03/MF A01 CSCL 07/4

A microscopic theory of field adsorption is used to study the adsorption and reaction of Nitric Oxide on a Pt(111) surface in high electrostatic fields. We find that below 0.4 volts/angstrom only NO is stably adsorbed. Above this value dissociation sets in that leads around 1.2V/A to the formation of nitrous oxide. A molecular orbital analysis is advanced to show the reaction pathway and to identify the stabilization mechanism. GRA

N90-26916# Cornell Univ., Ithaca, NY. Dept. of Chemistry.
PROBING INTERFACIAL STRUCTURE AND COMPOSITION WITH X RAY STANDING WAVES
Hector D. Abruns and Michael J. Bedzyk 4 Jun. 1990 42 p Submitted for publication
(Contract N00014-84-K-0656)
(AD-A223071; TR-19) Avail: NTIS HC A03/MF A01 CSCL 20/8

A brief description is given for the principles of x ray standing waves based on Bragg diffraction and total external reflection. The broad range applicability of this technique to probe interfacial structure and composition is illustrated by considering representative examples from the areas of adsorbate structures in ultra-high vacuum, potential dependent changes in an electrochemical systems and the study of ionic distributions at a model membrane. GRA

N90-26917# Ohio State Univ., Columbus.
SPECTROSCOPY OF IONS AND THEIR CLUSTERS Final Report, 12 Mar. 1986 - 30 Nov. 1989
Terry A. Miller 1 Dec. 1989 64 p
(Contract F19628-86-K-0022; AF Proj. 2303)
(AD-A223109; OSURF-765285/718164; GL-TR-89-0341) Avail: NTIS HC A04/MF A01 CSCL 20/5

Based upon mass spectrometric evidence as well as indirect speculations, molecular ions and their clusters have long been recognized as playing important roles in the chemistry of the earth's atmosphere. However, the (non-mass) spectroscopy of all large ions is difficult, with the spectroscopy of cluster ions being essentially non-existent. An apparatus is being constructed for the spectroscopic study of large ions, particularly ionic clusters. This apparatus allows the combination of laser induced fluorescence characterization of ions and their clusters while simultaneously identifying them by their time-of-flight mass spectra. This apparatus can make exciting contributions to the knowledge of how the electronic spectra of ions change as neutral species are clustered about them. Similarly, the manner in which such clusters react to radiation, i.e., fragmentation, fluorescence, etc., can be detailed by such experiments. GRA

N90-26918# Florida Univ., Gainesville. Dept. of Chemistry.
ION/MOLECULE REACTIONS OF ARSENIC AND PHOSPHORUS CLUSTER IONS: IONIZATION POTENTIALS AND NOVEL REACTION PATHWAYS Technical Report No. 29, Oct. 1989 - Mar. 1990
Jeffrey A. Zimmerman, Stephen B. Bach, Clifford H. Watson, and John R. Eyler 19 May 1990 32 p Submitted for publication
(Contract N00014-87-G-0248)
(AD-A222019) Avail: NTIS HC A03/MF A01 CSCL 07/4

Ionization potentials (IP's) for arsenic and phosphorus clusters (Asn, n = 1-5; Pn, n = 1-4) have been determined by gas phase charge transfer reactions. Arsenic and phosphorus cluster ions were generated by pulsed CO2 laser desorption from GaAs and InP substrates, mass selected, thermalized, and allowed to react with compounds of known ionization potential in a Fourier transform ion cyclotron resonance mass spectrometer. The IP's for As3 and As5, previously unreported, as well as more accurate IP values for several of the other clusters, have been determined. Products and rate coefficients for some interesting reactions of the cluster ions with the charge transfer agents are also reported. GRA

N90-26919# Cornell Univ., Ithaca, NY. School of Chemical Engineering.
THE ROLE OF HEAT TRANSFER DURING REACTIVE-ION ETCHING OF POLYMER FILMS
B. C. Dems and F. Rodriguez 7 May 1990 17 p Presented at the 34th International Symposium on Electron, Ion, and Photon Beams, San Antonio, TX, 29 May - 1 Jun. 1990
(Contract N00014-85-K-0474)
(AD-A222072; TR-17) Avail: NTIS HC A03/MF A01 CSCL 07/6

A study of the kinetics of oxygen and argon reactive-ion etching (RIE) of organic polymer films and an analysis of substrate heat transfer was carried out. Radiative heat transfer played a significant role in determining the substrate temperature profile during RIE. At the relatively low pressure of 5 milliTorr, where anisotropic etch profiles are typically achieved, radiative heat transfer accounted for nearly 85 percent of the total energy (heat) flux away from the substrate. RIE processing time (substrate temperarture) drastically affected the RIE rate of chain-scissioning polymers which included poly(methyl methacrylate) and poly(alpha-methylstyrene), while processing time had absolutely no effect on etch rates of cross-linking polymers. To confirm the role of radiative heat transfer during RIE, the underside of a silicon wafer was painted flat-black, which increased the total radiative surface emittance and lowered the steady-state substrate temperature for poly(methyl methacrylate) under a given set of RIE conditions. Thermal bonding alleviated substrate heating and greatly improved etch rate control, but the practical use of this method in a state-of-the-art system remains doubtful. GRA

N90-26920# Aerodyne Research, Inc., Billerica, MA. Center for Chemical and Environmental Physics.
LASER INDUCED SURFACE CHEMICAL EPITAXY Final Report, 1 Jan. 1988 - 31 Dec. 1989
Charter D. Stinespring and Andrew Freedman Mar. 1990 65 p
(Contract F49620-88-C-0029; AF Proj. 3005)
(AD-A222082; AFOSR-90-0522TR; RR-779) Avail: NTIS HC A04/MF A01 CSCL 07/5

Studies of the thermal and photon-induced surface chemistry of dimethyl cadmium (DMCd) and dimethyl tellurium (DMTe) on GaAs(100) substrates under ultrahigh vacuum conditions have been performed for substrate temperatures in the range of 123 K to 473 K. Results indicate that extremely efficient conversion of admixtures of DMTe and DMCd to CdTe can be obtained using low power 193 nanometers laser pulses at substrate temperatures of 123 K. Subsequent annealing at 473 K produces an epitaxial film. Given the similar electronic structure of other II-VI metal alkyls, such as dimethyl mercury, zinc, and selenium, it is believed that laser induced surface chemical epitaxy is suitable for producing patterned deposits of II-VI quantum well structures. GRA

N90-26921# Pittsburgh Univ., PA. Surface Science Center.
NI IMPURITY EFFECTS ON HYDROGEN SURFACE CHEMISTRY AND ETCHING OF SI(111)
R. M. Wallace, C. C. Cheng, P. A. Taylor, W. J. Choyke, and J. T. Yates, Jr. 21 May 1990 20 p Submitted for publication
(Contract N00014-82-K-0280)
(AD-A222083; TR-33) Avail: NTIS HC A03/MF A01 CSCL 07/4

The effect of impurity Nickel on the etching of Silicon by hydrogen chemisorption is examined in ultrahigh vacuum with Auger electron spectroscopy and temperature programmed desorption methods. It is found that a small surface concentration of Ni inhibits the production of Silane from atomic Hydrogen adsorption on the Si(111)-Ni surface. GRA

N90-26922# Texas Univ., Austin. Dept. of Physics.
HIGH RESOLUTION ELECTRON ENERGY LOSS SPECTROSCOPY STUDIES OF CHEMISORBED SPECIES ON METAL SURFACES Final Report, 1 Apr. 1986 - 31 Oct. 1989
J. L. Erskine 31 Mar. 1990 14 p
(Grant AF-AFOSR-0109-86; AF Proj. 2303)
(AD-A222272; AFOSR-90-0551TR) Avail: NTIS HC A03/MF A01 CSCL 07/4

The objective is to utilize high resolution electron energy loss spectroscopy and other spectroscopic tools to investigate chemical and physical properties of surfaces and of gas-surface interactions. Issues are addressed pertaining to bond lengths and site symmetry of chemisorbed atoms and molecules at metal surfaces, binding energies and vibrational frequencies associated with the atomic and molecular bonds, and with the driving mechanisms responsible for structural transformations which occur at surfaces as a result of chemisorption or other perturbations such as temperature change. Possible improvements in experimental techniques and data analysis which offer expanded applications are added along with research accomplishments of the program include a significant advancement in instrumentation, the first measurements of shear horizontal vibrational modes at crystal surfaces, the first detection of projected bulk phonon modes by surface electron scattering and elucidation of novel properties associated with hydrogen interaction at Niobium surfaces. GRA

N90-26923# Cornell Univ., Ithaca, NY. Dept. of Chemistry.
SYNTHESIS, STRUCTURE, ELECTRIC, AND MAGNETIC PROPERTIES OF CaNiN Technical Report No. 5, 1989 - 1990
Ming Y. Chern and Francis J. DiSalvo 30 Apr. 1990 21 p Submitted for publication
(Contract N00014-88-K-1039)
(AD-A222273) Avail: NTIS HC A03/MF A01 CSCL 07/2

There are only few known ternary nitrides containing both transition and alkaline earth metals. The recent research in nitrides has focused on the synthesis of ternary phases containing calcium and a transition metal; at least one new ternary compound is found in each Ca-M-N system. As part of this investigation, the synthesis and properties of a new compound, CaNiN, is reported. The oxidation state of Ni(I) in CaNiN is quite unusual for a solid state compound. Formally Ni(I) exists in hexagonal Ni3N. But the structure of Ni3N is basically a tripled face-centered cubic nickel framework with interstitial nitrogen in the octahedral holes, and has extensive Ni-Ni bonding. Another similar example is Ni3S2, in which formally Ni(I) and Ni(II) occur, but short Ni-Ni distances comparable with that in metallic nickel are again indicative of metal-metal bonding. GRA

N90-26924# Cornell Univ., Ithaca, NY. Dept. of Chemistry.
SYNTHESIS, STRUCTURE, AND PROPERTIES OF A NEW TERNARY METAL NITRIDE, Ca3CrN3 Technical Report No. 7, 1989 - 1990
Deborah A. Vennos, Michael E. Gadding, and Francis J. DiSalvo 30 Apr. 1990 21 p Submitted for publication
(Contract N00014-88-K-0139)
(AD-A222274) Avail: NTIS HC A03/MF A01 CSCL 07/2

A new ternary nitride, Ca3CrN3 (calcium chromium nitride) was synthesized from the binary nitrides at high temperature. The refined structure was solved in the Cmcm space group with lattice constants a=8.503(2), b=10.284(2), c=5.032(1), and R=3.9 percent, R(w)=3.9 percent. This new structure type consists of sheets of (CrN3)6(-) planar triangular units and calcium ions. Ca3CrN3 is insulating and paramagnetic with Cr3(+) in the low spin state. This is the first unambiguous example of low spin Cr3(+). Larger than expected antiferromagnetic interactions produce a maximum in the magnetic susceptibility at 245 K, even though the shortest Cr-Cr distance is 4.73A. GRA

N90-26925# University of Southern Mississippi, Hattiesburg. Dept. of Polymer Science.
FLUORESCENT PROBE INVESTIGATION OF A WATER-SOLUBLE POLYPHOSPHAZENE Technical Report No. 6, 1 Jun. 1989 - 31 May 1990
C. E. Hoyle, P. Wisian-Neilson (Southern Methodist Univ., Dallas, TX.), P. M. Chatterton, and M. A. Trapp 31 May 1990 22 p Submitted for publication Sponsored by ARO and NSF
(Contract N00014-89-J-1028)
(AD-A222317) Avail: NTIS HC A03/MF A01 CSCL 07/3

The fluorescent probes were utilized to investigate the microenvironment created by a water soluble polyphosphazene copolymer in aqueous solution. The combination of intensity, wavelength shift, and vibrational analysis measurements of the three small molecule probes is used to postulate an environment at high pH (with no added electrolyte) which is similar in polarity to methanol. In the absence of excess small molecule electrolyte, negatively charged probes are repelled by the charge on the polymer. Addition of small molecule electrolyte results in solubilization of the negatively charged probes. However, pyrene, even in the absence of added electrolyte (NaCl) is solubilized. Investigation of pyrene fluorescence quenching demonstrates the ability of the polyphosphazene copolymer to bind positively charged ions (Tl+) and repel negatively charged ions (I-). Neutral quenchers such as nitromethane readily penetrate the microenvironment of the polymer. GRA

N90-26926# Utah Univ., Salt Lake City. Dept. of Chemistry.
MEASUREMENTS OF ENERGY DISPERSION AT LIQUID-SOLID INTERFACES: FLUORESCENCE QUENCHING OF PYRENE BOUND TO FUMED SILICA Technical Report, Jul. 1989 - May 1990
A. L. Wong, Joel M. Harris, and D. B. Marshall (Utah State Univ., Logan.) 29 May 1990 32 p Submitted for publication
(Contract N00014-89-J-1412; NSF CHE-87-19266)
(AD-A222371; TR-18-ONR) Avail: NTIS HC A03/MF A01 CSCL 07/4

The observation of a stretched exponential response in chemical kinetics at solid-liquid interfaces is an indicator of solid surface disorder. In this contribution, we review earlier relaxation kinetics studies of solid surface disorder and the statistical criteria analyzing kinetic data which are not single exponential. We draw on these concepts to interpret the fluorescence decay kinetics of pyrene covalently attached to the surface of fumed silica particles which are suspended in methanol. These results, along with the diffusional length of the iodine quencher, the photophysics of the probe, and the chemistry of the interface, indicate that the kinetic inhomogeneity is dominated by dispersion of surface energies, rather than by diffusional excursions of the quencher on a fractally aggregated surface. GRA

N90-26927# Pittsburgh Univ., PA. Surface Science Center.
THE ADSORPTION AND THERMAL DECOMPOSITION OF PH3 ON Si(111)-(7X7)
P. A. Taylor, R. M. Wallace, W. J. Choyke, and J. T. Yates, Jr. 18 May 1990 42 p Submitted for publication
(Contract N00014-82-K-0280)
(AD-A222417; TR-31) Avail: NTIS HC A03/MF A01 CSCL 07/4

The adsorption of PH3 (Phosphine) on Silicon(111)-(7x7) was studied by Auger electron spectroscopy and temperature programmed desorption. PH3 was found to exhibit two kinds of behavior on the surface. A small surface coverage of molecularly adsorbed PH3 desorbs without and dissociative surface chemistry. For the majority of the adsorbed, PHx species (3 greater than x greater than 1) dissociation occurs to form P(a) and H(a). At 120 K, PH3 initially adsorbs as the reactive species with a sticking coefficient of S approx. 1 up to approx. 75 percent saturation. Capping the Si-dangling bonds with atomic deuterium prevents PH3 adsorption, indicating that the dangling bonds are the PH3

adsorption sites. Isotopic studies involving Si-D surface species mixed with adsorbed PHx species indicate that PH3 desorption does not occur through a recombination process. Finally, additional PH3 may be adsorbed if the surface hydrogen produced by dissociation of PH3 is removed. GRA

N90-26928# Washington Univ., Seattle. Dept. of Chemistry.
MAGNETIC RESONANCE ELUCIDATION OF MOLECULE/MACROMOLECULE INTERACTION STEREOCHEMISTRY Annual Report, Feb. 1989 - Mar. 1990
Niels H. Andersen 30 Apr. 1990 9 p
(Contract N00014-88-K-0202; NR Proj. RR0-4106)
(AD-A221444) Avail: NTIS HC A02/MF A01 CSCL 07/4

Software was developed for: simulating accurate theoretically NOESY spectra based on model structures, motional assumptions, and experimental parameters; the statistical comparison of model dependent calculated spectra and experimental data; and the automated extraction of experimental constraints from raw NOESY data. The latter program (DISCON) was tested using data for a rigid steroid model (in both the small molecule and slow tumbling regime) and simulated data for both a B-deoxyribonucleic acids and peptide structure. It is currently being used to refine the structures of: gonadotropin-releasing hormone analogs, several peptide macrolide antibiotics, yeast alpha-factor and small neuropeptides in micelle-associated states, and endothelin (a 21mer bisdisulfide vasoconstrictor produced in the endothelium of the vasculature). GRA

N90-26929# Pittsburgh Univ., PA. Surface Science Center.
PH3 SURFACE CHEMISTRY ON Si(111)-(7X7): A STUDY BY AUGER SPECTROSCOPY AND ELECTRON STIMULATED DESORPTION METHODS
R. M. Wallace, P. A. Taylor, W. J. Choyke, and J. T. Yates, Jr. 11 Apr. 1990 43 p Submitted for publication
(Contract N00014-82-K-0280)
(AD-A221508; TR-29) Avail: NTIS HC A03/MF A01 CSCL 07/4

The adsorption and decomposition of phosphine hydride on silicon (III)-(7x7) was investigated in ultrahigh vacuum by means of temperature programmed desorption (TPD), low-energy electron diffraction (LEED), Auger electron spectroscopy (AES) and electron stimulated desorption (ESD) methods. Phosphine adsorbs on Si(III)-(7x7) at T=120 K with an initial sticking coefficient of S(o) equivalent to 1 through a mobile (extrinsic) precursor state. Some PH3 dissociative adsorption at 120 K is observed. Thermal activation of the adsorbed species results in desorption of a molecular PH3 species up to 550 K. Further heating produces H2(g) desorption at T equivalent to 740 K and P2(g) desorption at T equivalent to 1010 K, thus indicating that PH3 decomposition has occurred. AES and ESD studies of the adsorbed species reveal that decomposition takes place by the breaking of P-H bonds in PHx(a) to form Si-H species on the surface for 120 K less than T less than 700 K. GRA

N90-26930# International Business Machines Corp., San Jose, CA. Research Div.
PHASE-SENSITIVE OPTICAL DETECTION OF BALLISTIC PHONON PULSES USING FREQUENCY-MODULATION SPECTROSCOPY AND PERSISTENT SPECTRAL HOLES Interim Technical Report
W. P. Ambrose and W. E. Moerner 4 May 1990 47 p Submitted for publication
(Contract N00014-84-C-0708)
(AD-A221521; IBM-RJ7693; TR-26) Avail: NTIS HC A03/MF A01 CSCL 20/5

Using laser frequency-modulation spectroscopy and persistent spectral holes, time-resolved phase-sensitive probing of ballistic phonons generated by an absorbed Nd:YAG laser pulse is accomplished in the interior of a solid sample. Measurement of the time dependence and sign of a propagating stress-strain field is illustrated using spectral holes in the in-homogeneously broadened 607 nm color center absorption in x-irradiated NaF at liquid-helium temperatures. By examining the dependence of the observed phonon time-of-flight data on the polarization of the probing light, the position within the sample, and the phase of FM detection, an identification of the acoustic polarizations of the propagating phonons may be made. The effects of phonon focusing and mode conversion upon reflection must be taken into account to complete the identification. Along with ability to determine the sign of the acoustic disturbance, this experiment features a strain detection limit of 4 x 10 to the -9th power at a time resolution of 50 ns. GRA

N90-26931# Northeastern Univ., Boston, MA. Dept. of Physics.
INTERFACIAL VISCOSITY MEASUREMENTS OF ADSORBED MONOLAYERS ON METAL SURFACES Annual Report, 1 May 1989 - 30 Apr. 1990
Jacqueline Krim 30 Apr. 1990 7 p
(Contract N00014-89-J-1853)
(AD-A221689) Avail: NTIS HC A02/MF A01 CSCL 07/4

At this writing, the ONR award has been in effect for one year. The construction of a second deposition system and improvements on one of the existing gas adsorption systems were performed. Upon completion of this work, the slipping behavior of several model liquid films adsorbed on silver and gold substrates was investigated. This work, presented at the most recent AVS meeting, provided an initial survey of the types of behavior which will be encountering throughout the course of the investigations. This work has also demonstrated a general trend among monolayers: the lighter molecular weight films appear to slip for longer characteristic times. Studies of the interfacial viscosity of xenon and krypton films on Au(111) were carried out. The particular interest here was to map out temperature dependencies of the interfacial viscosities (sometimes referred to as coefficients of sliding friction) in order to allow future comparison with theory. GRA

N90-26932# Vanderbilt Univ., Nashville, TN. Dept. of Physics and Astronomy.
SURFACE REACTIONS IN THE SPACE ENVIRONMENT Final Report, 1 Oct. 1986 - 30 Sep. 1989
Norman H. Tolk and Richard F. Haglund 3 May 1990 26 p
(Contract F49620-86-C-0125; AF Proj. 3484)
(AD-A221767; AFOSR-90-0623TR) Avail: NTIS HC A03/MF A01 CSCL 07/4

A central goal has been to establish a multidisciplinary Center of Excellence concentrating on the atomic-scale dynamics of surface reactions in the space environment. The major research focus has been the investigation of the ways in which energy deposited by incident atoms, ions, electrons and short wavelength photons is absorbed and localized to produce bond-making and bond-breaking on surfaces and in the near-surface bulk. Knowledge of these microscopic mechanisms provides detailed clues which lead to an understanding of the macroscopic processes which manifest themselves as surface erosion, modification and damage. This research program bears directly on a broad spectrum of questions germane to the long-term operation of platforms in space, including long-term structural, optical and electronic degradation of materials in the ambient near-earth environment, survivability under and hardening against irradiation from directed-energy weapons, vulnerability in disturbed nuclear atmospheres, and discrimination and sensing techniques based on characteristic radiation (glow) signatures. Significant, and in some cases, startling progress has been made in carrying out the research goals of this effort. GRA

N90-26933# Stanford Univ., CA. Dept. of Mechanical Engineering.
TURBULENT REACTING FLOWS AND SUPERSONIC COMBUSTION Final Report, 1 Oct. 1986 - 30 Sep. 1989
C. T. Bowman, Ronald K. Hanson, M. G. Mugal, and W. C. Reynolds 15 Jan. 1990 38 p
(Contract F49620-86-K-0022; AF Proj. 3484)
(AD-A221793; AFOSR-90-0504TR) Avail: NTIS HC A03/MF A01 CSCL 21/2

An experimental and computational investigation of supersonic

combustion flows was carried out. The principal objective of the research was to gain a more fundamental understanding of mixing and chemical reaction in supersonic flows. The research effort comprised three inter-related elements: (1) an experimental study of mixing and combustion in a supersonic plane mixing layer; (2) development of laser-induced fluorescence techniques for time-resolved two-dimensional imaging of species concentration, temperature and velocity; and (3) numerical simulations of compressible reacting flows. The specific objectives and the results of the research is summarized. GRA

N90-26934# Colorado State Univ., Fort Collins. Dept. of Chemistry.
SUPERSONIC JET STUDIES OF BENZYL ALCOHOLS: MINIMUM ENERGY CONFORMATIONS AND TORSIONAL MOTION
Hoong-Sun Im, E. R. Bernstein, Jeffrey I. Seeman, and Henry V. Secor 13 May 1990 54 p
(Contract N00014-79-C-0647)
(AD-A221815) Avail: NTIS HC A04/MF A01 CSCL 07/4

Supersonic jet mass resolved excitation spectroscopy is employed to determine the minimum energy conformations of benzyl alcohol and a series of nine methyl-, ethyl-, fluoro-, and aminobenzyl alcohols. The interpretation of the time-of-flight mass spectra (TOFMS) of these molecules leads to the assignment of specific molecular geometries for each system. The minimum energy conformation of the -CH2O moiety is determined to be perpendicular relative to the plane of the aromatic ring. The hydroxy proton in the sterically unemcumbered benzyl alcohol points toward the benzene ring. The potential energy barrier for the low frequency torsional motion of the hydroxymethyl group arises mainly from an internal hydrogen bonding interaction between the OH group and pi-system of the ring. GRA

N90-27582*# AeroChem Research Labs., Inc., Princeton, NJ.
AN IONIC MECHANISM OF CARBON FORMATION IN FLAMES Abstract Only
H. F. Calcote *In* NASA, Ames Research Center, Carbon in the Galaxy: Studies from Earth and Space Apr. 1990 p 325-326 (For primary document see N90-27562 21-88)
Avail: NTIS HC A15/MF A02 CSCL 21B

N90-27585*# Los Alamos National Lab., NM.
DIAMONDS IN DETONATION SOOT Abstract Only
N. Roy Greiner, Dave Phillips, J. D. Johnson, and Fred Volk (Fraunhofer-Inst. fuer Treib- und Explosivstoffe, Pfinztal-Berghausen, Germany, F.R.) *In* NASA, Ames Research Center, Carbon in the Galaxy: Studies from Earth and Space Apr. 1990 p 330 (For primary document see N90-27562 21-88)
Avail: NTIS HC A15/MF A02 CSCL 11G

N90-27592*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, MD.
FT-IR SPECTROSCOPIC STUDIES OF POLYCYCLIC AROMATIC HYDROCARBONS Abstract Only
D. W. Salisbury, J. E. Allen, Jr., B. Donn, W. J. Moore, and R. K. Khanna (Naval Research Lab., Washington, DC.) *In* NASA, Ames Research Center, Carbon in the Galaxy: Studies from Earth and Space Apr. 1990 p 341 (For primary document see N90-27562 21-88)
Avail: NTIS HC A15/MF A02 CSCL 07D

26 METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

N90-26935*# Texas Univ., El Paso. Dept. of Metallurgical and Materials Engineering.
THE EFFECT OF IMPURITY GASSES ON VARIABLE POLARITY PLASMA ARC WELDED 2219 ALUMINUM
John C. McClure, Martin R. Torres, Alan C. Gurevitch, and Robert A. Newman 31 Aug. 1989 152 p
(Contract NAS8-37425)
(NASA-CR-183803; NAS 1.26:183803) Avail: NTIS HC A08/MF A01 CSCL 11F

Variable polarity plasma arc (VPPA) welding has been used with considerable success by NASA for the welds on the Space Shuttle External Tank as well as by others concerned with high quality welded structures. The effects of gaseous contaminants on the appearance of VPPA welds on 2219 aluminum are examined so that a welder can recognize that such contamination is present and take corrective measures. There are many possible sources of such contamination including, contaminated gas bottles, leaks in the gas plumbing, inadequate shield gas flow, condensed moisture in the gas lines or torch body, or excessive contaminants on the workpiece. The gasses chosen for study in the program were nitrogen, oxygen, methane, and hydrogen. Welds were made in a carefully controlled environment and comparisons were made between welds with various levels of these contaminants and welds made with research purity (99.9999 percent) gasses. Photographs of the weld front and backside as well as polished and etched cross sections are presented. Author

N90-26936# Tennessee Univ., Knoxville. Inst. for Applied Microbiology.
MICROBIALLY INFLUENCED CORROSION OF CARBON STEELS
D. C. White, R. F. Jack, N. J. E. Dowling, M. J. Franklin, D. E. Nivens, S. Brooks, M. W. Mittelman, A. A. Vass, and H. S. Isaacs (Brookhaven National Lab., Upton, NY.) 1990 12 p Presented at the NACE Corrosion Conference, Las Vegas, NV, 23-277 Apr. 1990
(Contracts DE-AC02-76CH-00016; N00014-86-K-0275; N00014-87-K-0012)
(DE90-012231; BNL-44644; CONF-900403-11; GRI-5088-260-1747) Avail: NTIS HC A03/MF A01

Microbially influenced corrosion of pipeline steels is an economically important problem. Microbes form tubercles which block fluid flow and can facilitate localized corrosion leading to through-wall penetrations. Microbes of diverse physiological types and metabolic potentialities have been recovered from fresh tubercles or under-deposit corrosion and have been characterized. In tests utilizing sterilizable flow-through systems containing pipeline steel coupons, corrosion rates determined by nondestructive electrochemical means have indicated that increasing the number of physiological types of microbes inoculated into the system generally increased the severity of the microbially influenced corrosion (MIC). This study reports the MIC of monocultures and combinations of monocultures in an aerobic fresh water system with low sulfate and an anaerobic saline system. In both the aerobic and anaerobic systems, the combination of microbes induced greater MIC responses than the monocultures. In tests involving a combination of microbes in both systems in which one member was a sulfate-reducing bacteria (SRB), the corrosion mechanism was different for the control and the monocultures. This difference was indicated by the phase shift in the electrochemical impedance spectra (EIS). The localization of corrosion, that in many cases is the hallmark of MIC, may be initiated by the inhomogeneities of supposedly smooth metal surfaces. The scanning vibrating electrode technique (SVET) demonstrated non-uniform current densities over carbon steel electrodes polished to a 600 grit finish suggesting pitting and repassivation of pits in sterile medium. DOE

N90-26937# Nebraska Univ., Lincoln.
FUNDAMENTAL STUDIES OF STRONGLY MAGNETIC RARE EARTH-TRANSITION METAL ALLOYS
G. Holmes 1990 5 p
(Contract DE-FG02-86ER-45262)
(DE90-012458; DOE/ER-45262/3) Avail: NTIS HC A01/MF A01

The aim of this research is to deepen the understanding of new strongly magnetic rare earth-transition metal compounds and alloys. Such materials have high potential as hard or semi-hard permanent magnet materials with energy-related and other

applications. The phases investigated generally are based on iron or cobalt, often include light rare earths, and often are ternary alloys with anisotropic hexagonal or tetragonal structures. Several types of system are studied including new Fe-rich ternary phases, melt-spun and heat treated alloys containing disorder which are reached by intermediate metastable phases, and sputtered thin films and multilayers. The aim is to understand these relatively complex materials on the basis of fundamental electronic structure, theories of itinerant magnetism, and the microstructural effects which control the extrinsic properties. To this end a broad range of experiments and calculations are performed. DOE

N90-26938# Stanford Univ., CA. High Temperature Gasdynamics Lab.

THE THERMAL RADIATIVE PROPERTIES OF METALS AT HIGH TEMPERATURE

S. A. Self 1990 4 p Prepared for LLNL, CA
(Contract W-7405-eng-48)
(DE90-012468; UCRL-21021-Rev-1) Avail: NTIS HC A01/MF A01

A knowledge of the optical radiative properties of the surfaces of various metals at high temperatures, up to and above the melting point, is of considerable technical importance for a number of applications. These include smelting and casting, welding by TIG, E-beam and laser methods, and thermal and E-beam evaporative sources for thin film and composite deposition. The optical/radiative properties are important in modeling the energy balance in such applications. Accurate information is required on the surface absorptivity, reflectivity and emissivity as a function of wavelength, temperature and angle relative to the surface normal. These parameters are known to be sensitive functions of the state of the surface, including crystalline state and surface roughness for the solid phase, and the oxidation state of the surface for both solid and liquid metals. The principal thrust of this work is to obtain detailed and accurate data on the optical/radiative properties of pure aluminum and uranium at temperatures up through their melting points. However, it should be added that with the development of apparatus techniques and expertise completed, the facility will be available for optical/radiative property measurements on a variety of materials of interest to various programs at LLNL. DOE

N90-26939# Japan Atomic Energy Research Inst., Tokai.

FILLER METAL DEVELOPMENT FOR HASTELLOY ALLOY XR

Katsutoshi Watanabe, Hajime Nakajima, Kensho Sahira, Nobuyoshi Kurauchi, Toshiki Takeiri, Teiichiro Saitoh, Tamao Takatsu, and Tsuneo Nakanishi (Mitsubishi Metal Corp., Omiya, Japan) Dec. 1989 126 p In JAPANESE; ENGLISH summary
(DE90-791084; JAERI-M-89-206) Avail: NTIS (US Sales Only) HC A07

A method of alloy designing has been proposed and validated to develop the filler metal for Hastelloy alloy XR (nuclear reactor grade of Hastelloy alloy X), which is the candidate material for high temperature structure of High-Temperature Engineering Test Reactor (HTTR). In the filler metal development for Hastelloy alloy XR, materials of two heats were melted and fabricated with special emphasis placed on manufacturing process. One is the trial products (alloy termed C) designed by using multiple regression analysis in the range of the chemical composition specified as Hastelloy alloy X. The other is filler metal (alloy termed D) with optimum boron content in the same chemical composition as Hastelloy alloy XR. The results of the tests on several key items may be summarized as follows: (1) Weldments with alloy C showed higher strength and ductility at elevated temperatures than those of alloy D. (2) Weldments with alloy D had more excellent strength characteristics at elevated temperatures than those of the other conventional filler metals. (3) As for weldability, the crater cracks were slightly observed in the FISCO cracking test, but those were out of the problem in the degree of cracking from the viewpoint of practical application. The results of qualification tests on weldability showed good performance for all welding conditions of the present experiments. On the other hand, the mechanism of hot cracking initiation and the controlling factors in hot cracking susceptibility with relation to boron content have been clarified for Hastelloy alloy XR base metal. DOE

N90-26940*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, AL.

SOLIDIFICATION PROCESSING OF ALLOYS USING AN APPLIED ELECTRIC FIELD Patent Application

Eugene C. McKannan, inventor (to NASA), Deborah D. Schmidt, inventor (to NASA), Shaffiq Ahmed, inventor (to NASA), and Robert W. Bond, inventor (to NASA) (Alabama Univ., Huntsville.) 31 May 1990 21 p
(NASA-Case-MFS-26083-1-CU; NAS 1.71:MFS-26083-1-CU; US-Patent-Appl-SN-531375) Avail: NTIS HC A03/MF A01 CSCL 11F

A method is provided for obtaining an alloy having an ordered microstructure which comprises the steps of heating the central portion of the alloy under uniform temperature so that it enters a liquid phase while the outer portions remain solid, applying a constant electric current through the alloy during the heating step, and solidifying the liquid central portion of the alloy by subjecting it to a temperature-gradient zone so that cooling occurs in a directional manner and at a given rate of speed while maintaining the application of the constant electric current through the alloy. The method of the present invention produces an alloy having superior characteristics such as reduced segregation. After subsequent precipitation by heat-treatment, the alloys produced by the present invention will have excellent strength and high-temperature resistance. NASA

N90-26941# California Univ., Berkeley. Lawrence Berkeley Lab. Center for Advanced Materials.

WELDMENT MECHANICAL PROPERTIES OF ALUMINUM-COPPER-LITHIUM ALLOY, 2090, AT AMBIENT AND CRYOGENIC TEMPERATURES Ph.D. Thesis

Anne Jin Sunwoo May 1990 84 p Prepared in cooperation with California Univ., Berkeley
(Contract DE-AC03-76SF-00098)
(DE90-014178; LBL-28968) Avail: NTIS HC A05/MF A01

Weldment mechanical properties of Al-Cu-Li alloy, 2090, at ambient and cryogenic temperatures have been investigated. The primary objective of this work is to develop a mechanistic understanding of the weldment mechanical properties with specific emphasis on their relation to the fusion zone and heat affected zone microstructures. In the fusion zone, prior thermomechanical processing of the base metal is erased during welding. The as-welded and post-weld heat treated fusion zones lack the precipitates, size, volume fraction, and homogeneity of the base metal. The T(sub 1) precipitates are found either in the vicinity of other intermetallics or at the boundaries. Low weldment elongation is caused by the formation of intermetallics and continuous film on the boundaries. Even with alloy addition to the fusion zone, the strength mismatch continues to exist due to the difference in strengthening mechanism: solid solution strengthening in the fusion zone and precipitation strengthening in the base metal. The ultimate tensile strength of the as-welded weldments is only 50 percent of the metal yield strength, and localized deformation occurs in the softer fusion zone. A weldment elongation increases substantially with increasing Cu content in the fusion zone at both test temperatures. Magnesium additions to the fusion zone change the dendrite morphology, affecting the distribution of Cu segregation at the boundaries. The Mg welds show higher yield strengths, but the Cu-Mg combination leads to embrittlement. The difference in properties of the heat affected zone and the base metal is primarily caused by the dissolution of strengthening phases. At 578 K, the strength degrades due to dissolution of delta prime phase and at 773 K, dissolution of T(sub 1) phase. At 648 K, the growth of the equilibrium phases occurs: T(sub 1) at both the matrix and the subgrain boundaries, and T(sub 2) at the grain boundaries. DOE

N90-26942# Dayton Univ., OH. Research Inst.
METALLURGICAL PROCESSES IN MULTI-COMPONENT RARE EARTH-TRANSITION METAL PERMANENT MAGNET ALLOYS Final Report, 15 May 1987 - 14 May 1990
Alden E. Ray 30 May 1990 8 p
(Contract DAAL03-87-K-0082)
(AD-A222891; UDR-TR-90-57; ARO-24671.9-MS) Avail: NTIS HC A02/MF A01 CSCL 11/6

The primary objective has been to improve and extend the technology of 2:17 type permanent magnets. The research has proceeded by employing a model for the complex metallurgical behavior of these alloys. During the three year period of this research, a record value (BH)max=34 MGOe was established for energy product in uncompensated Sm(CouFevCuxZry)z magnets. This was achieved by increasing the Fe content to v=0.31 to 0.33 (28 to 30 at. percent) while developing heat treatments to maintain the coercivity at high levels. GRA

N90-26943# Martin Marietta Aerospace, Denver, CO. Astronautics Group.
FABRICATION OF INTERMETALLIC COMPOUNDS BY SOLID STATE REACTION OF ROLL-BONDED MATERIALS Quarterly Letter Report No. 15, 10 Feb. - 9 May 1990
William G. Moshier 9 May 1990 8 p
(Contract N00014-85-C-0857)
(AD-A221960; MCR-85-721) Avail: NTIS HC A02/MF A01 CSCL 11/6

Intermetallic compounds offer very specific material properties and property retention at elevated temperatures. However, reliable processing techniques to fabricate these materials have not been developed. This program will investigate the use of a novel, low cost fabrication technique involving a deformation-solid state reaction bonding process to form titanium beryllides. The interaction between Ti and Be was characterized with co-extruded material that was placed into Ta-lined steel cans and reacted under pressure. The Ti/Be molar ratio for this study was 1:2. The starting material was Be fibers that were wrapped with Ti foil. The first extrusion reduced the size of the Be wires from 2.5 mm to 1.1 mm. Testing was conducted on this material to obtain data on the reaction rate, sequence, and rate between Ti and Be. The rate of the reaction was analyzed at only one temperature and one pressure, i.e., 1000 C and 20,000 psi. GRA

N90-26944# Pennsylvania State Univ., University Park.
MICROSTRUCTURAL DEVELOPMENT IN HSLA-100 STEEL WELD METALS Annual Progress Report No. 1
Paul R. Howell 1990 38 p
(Contract N00014-89-J-1958)
(AD-A222105) Avail: NTIS HC A03/MF A01 CSCL 11/6

Light microscopy, scanning electron microscopy (SEM) and transmission electron microscopy (TEM) have been employed to examine the decomposition of austenite in high-strength low alloy 100 steels. The as-received plate had been quenched and tempered and low magnification imaging suggested that the microstructure comprised lath martensite and granular bainite. However, at higher magnifications, much of the so-called granular bainite was found to consist of equiaxed ferrite which contained pools of austenite and/or martensite. The tempering treatment yielded fine dispersions of epsilon-copper, with both the lath martensite and the granular bainite. Finally, the occasional observation of interphase precipitation in association with ferrite suggests that the proeutectoid ferrite reaction had initiated prior to quenching from the austenizing temperature. For samples which had been reaustenitized and ice-water quenched, the microstructure consisted primarily of lath martensite although some granular bainite also observed. Slow (furnace) cooling from the austenitic range yielded an equiaxed grain structure which could be designated as granular bainite. GRA

N90-26945# Naval Research Lab., Washington, DC. Physical Metallurgy Branch.
PASSIVE MECHANISMS OF SURFACES PRODUCED BY ION BEAM MIXING AND ION IMPLANTATION Annual Report, Oct. 1988 - Nov. 1989
P. M. Natishan, E. McCafferty, and G. K. Hubler May 1990 27 p
(Contract N00014-90-WX-24009)
(AD-A222432; NRL-PUB-167-6320) Avail: NTIS HC A03/MF A01 CSCL 11/6

The corrosion behavior of Mo-Al, Cr-Al and Cr-Mo-Al surface alloys produced by ion implantation and ion beam mixing was examined in deaerated, 0.1M NaCl. The polarization behavior of the ion implanted samples was similar to that of Al and the pitting potentials of the ion implanted samples were 115 to 155 mV higher than that of Al. From the standpoint of the Ph sub pzc model this behavior would be explained by the presence of the implanted cations in the stable oxide lattice. There was incomplete mixing of the coating and substrate for the ion beam mixed samples, and the mixed elements remained almost entirely in the metallic state so that the desired mixed oxide films were not formed. Ion beam mixing did impart additional stability compared to as-deposited samples since the mixing process produced more compact coatings. GRA

N90-26946# Naval Research Lab., Washington, DC. Mechanics of Materials Branch.
DETERMINATION OF THE HEAT DISSIPATED FROM A SPECIMEN UNDERGOING CYCLIC PLASTICITY BY A HYBRID NUMERICAL/EXPERIMENTAL METHOD
A. K. Wong and G. C. Kirby, III 14 May 1990 36 p Sponsored by Naval Sea Systems Command, Washington, DC
(AD-A221575; NRL-MR-6633) Avail: NTIS HC A03/MF A01 CSCL 11/6

When a metallic specimen is deformed plastically, the bulk of the irreversible work is dissipated in the form of heat. It is generally accepted that the remaining part of the input energy is consumed by the change in the material's internal energy. Such internal energy changes can be attributed to phase changes, development of residual stresses, translation of dislocations; and the creation and/or enlargement of internal surfaces such as voids. Recent interests in deformation heating have primarily been motivated by metal forming processes where the substantial heat generation greatly influences the formability. A combined experimental/numerical approach is taken to decompose the hysteresis energy of a tensile specimen undergoing fully reversed plastic cycling into heat generation and internal energy in accordance with the first law of thermodynamics and the one dimensional diffusion equation with internal sources. Because of the difficulties in determining accurate boundary conditions and the sensitivity of the solution to the boundary conditions, the finite difference method was complemented with Lagrange multipliers. The sum of the square of the difference between the measured temperature and the predicted temperature at specific points along the specimen axis were minimized subject to the constraint of the finite difference template used. Results from preliminary tests indicate that when a critical energy density is reached failure occurs. GRA

N90-26947# Army Materials Technology Lab., Watertown, MA. Metals Research Branch.
PROCESSING AND CHARACTERIZATION OF HIGH STRENGTH, HIGH DUCTILITY HADFIELD STEEL Final Report M.S. Thesis - Worcester Polytechnic Inst., MA, Aug. 1989
John F. Chinella Apr. 1990 137 p
(AD-A221769; MTL-TR-90-21) Avail: NTIS HC A07/MF A01 CSCL 20/11

Hadfield steel plastic flow behavior is known by strain hardening without necking to high levels of strength and strain, and is described by upward curvature strain hardening with near-constant, near-linear strain hardening rates over large ranges of deformation temperature. This plastic flow behavior is valued for severe

applications, but Hadfield steel yield stress is low. The purpose of this experimental study is to warm roll solution treated, iron 12.5 manganese, 2.01 molybdenum, 1.15 carbon Hadfield steel to high yield strength and to retain the valued characteristics of Hadfield steel plastic flow behavior. The objective of the study is to determine the effects of warm rolling on plastic flow behavior and microstructure of Hadfield steel. Experimental plastic flow behavior is evaluated in tension from both engineering and true stress-strain behavior. The purpose of the study is met by material thermomechanically processed to provide high yield stress, moderate rates of increasing load or strain hardening, high true uniform strain and ultra-high true uniform stress. The experimental stress-strain curves and microstructures suggest an influence of Hadfield steel deformation twins on plastic flow. GRA

N90-26948# Pennsylvania State Univ., University Park. Dept. of Materials Science and Engineering.
ADVANCED PROCESSING AND PROPERTIES OF HIGH PERFORMANCE ALLOYS Technical Report, No. 16, 1 Jan. - 31 Dec. 1989
D. A. Koss Apr. 1990 24 p
(Contract N00014-86-K-0381)
(AD-A221776) Avail: NTIS HC A03/MF A01 CSCL 11/6

Progress is reviewed for a research program whose purpose is to establish a broad-based understanding of the application and consequences of advanced processing techniques, especially as they influence the strength and fracture resistance of high performance structural alloys. While some of the research is specific to certain alloy systems, much of the program constitutes a fundamental study of the deformation and fracture of engineering alloys containing processing induced defects. Progress is reviewed for the following projects within the program: modeling the effects of pores or voids on fracture, the processing and properties of Cu-Nb alloy, and a new age-hardenable beta titanium system. GRA

N90-26949# Rockwell International Science Center, Thousand Oaks, CA.
RESEARCH ON SPUTTERING OF FERROELECTRIC THIN FILMS Final Report, 1 May 1986 - 31 Dec. 1989
R. R. Neurgaonkar Feb. 1990 65 p
(Contract F49620-86-C-0052; AF Proj. 2306)
(AD-A221792; SC5458.FR; AFOSR-90-0508TR) Avail: NTIS HC A04/MF A01 CSCL 11/6

The magnetron sputtering technique was used to grow morphotropic phase boundary ferroelectric thin films of tungsten bronze PBN:60 and pervoskite PLZT. Film crystallinity was found to be strongly influenced by substrate temperature, with temperatures of 500 to 600 C usually required. Single crystal PBN:60 films were grown on SBN:60 substrates, whereas grain-oriented films were achieved on (100)-oriented Si substrates. PLZT films are grain-oriented for (001)-oriented SBN and have excellent surface quality for guided wave applications. This is the first time such films were grown on tungsten bronze substrates. Both PBN:60 and PLZT films present a great promise for SLM and electronic memory applications. GRA

27 NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

For composite materials see *24 Composite Materials.*

N90-26950# Midwest Research Inst., Kansas City, MO.
GUIDANCE DOCUMENT FOR SELECTING ANTISKID MATERIALS APPLIED TO ICE- AND SNOW-COVERED ROADWAYS Final Report
J. S. Kinsey, C. Cowherd, and K. Connery Jan. 1990 135 p
(Contract EPA-68-02-4395)
(PB90-183658; EPA/450/3-90/007) Avail: NTIS HC A07/MF A01 CSCL 11C

Those physical properties that can be used to select clean, durable antiskid materials (salt and sand) are identified and quantified. Test methods used to quantify the physical properties are either included or identified. Author

N90-26951# California Univ., Berkeley. Dept. of Materials Science and Mineral Engineering.
APPLICATION OF MICRODESIGNED INTERFACES TO STUDIES OF CERAMIC PROCESSING
A. M. Glaeser Feb. 1990 15 p Presented at the 3rd International Conference on Ceramic Powder Processing Science, San Diego, CA, 4-7 Feb. 1990 Prepared in cooperation with California Univ., Berkeley, Lawrence Berkeley Lab.
(Contract DE-AC03-76SF-00098)
(DE90-011633; LBL-27702; CONF-900218-3) Avail: NTIS HC A03/MF A01

A recently developed technique, which utilizes photolithographic methods developed in the semiconductor industry in conjunction with ion beam milling and hot pressing, allows the production of submicron-scale, controlled-geometry, controlled-crystallography pore or defect structures at internal interfaces in controlled misorientation bicrystals, single crystal-polycrystal ensembles, and polycrystal-polycrystal ensembles. Such microdesigned pore structures provide a new tool for studying processes during several stages of processing. The application of the technique to studies of processes as diverse as binder removal and redistribution to pore-boundary separation in alumina is described. Additional research applications and future trends are indicated. DOE

N90-26952*# National Aeronautics and Space Administration. Pasadena Office, CA.
SILICON CONTAINING ELECTROCONDUCTIVE POLYMERS AND STRUCTURES MADE THEREFROM Patent Application
Ganesan Nagasubramanian, inventor (to NASA), Salvador DiStefano, inventor (to NASA), and Ranty H. Liang, inventor (to NASA) (Jet Propulsion Lab., California Inst. of Tech., Pasadena.) 7 Feb. 1990 22 p
(Contract NAS7-918)
(NASA-Case-NPO-17826-1-CU; NAS 1.71:NPO-17826-1-CU; US-Patent-Appl-SN-479485) Avail: NTIS HC A03/MF A01 CSCL 11C

An electropolymerized film comprised of polymers and copolymers of a monomer is formed on the surface of an anode. The finished structures have superior electrical and mechanical properties for use in applications such as electrostatic dissipation and for the reduction of the radar cross section of advanced aircraft. NASA

N90-26953*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
IMIDE/ARYLENE ETHER COPOLYMERS Patent Application
Brian J. Jensen, inventor (to NASA), Paul M. Hergenrother, inventor (to NASA), and Robert G. Bass, inventor (to NASA) (Virginia Commonwealth Univ., Richmond.) 21 Nov. 1989 21 p
(NASA-Case-LAR-14159-1-CU; NAS 1.71:LAR-14159-1-CU; US-Patent-Appl-SN-439317) Avail: NTIS HC A03/MF A01 CSCL 11C

Imide/arylene ether block copolymers are prepared by reacting anhydride terminated poly(amic acids) with amine terminated poly(arylene ethers) in polar aprotic solvents and chemically or thermally cyclodehydrating the resulting intermediate poly(amic acids). The resulting block copolymers have one glass transition temperature or two, depending upon the particular structure and/or the compatibility of the block units. Most of these block copolymers form tough, solvent resistant films with high tensile properties. NASA

N90-26954*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
POLYIMIDAZOLES VIA AROMATIC NUCLEOPHILIC DISPLACEMENT Patent Application
John W. Connell, inventor (to NASA) and Paul M. Hergenrother, inventor (to NASA) 12 Apr. 1990 17 p

(NASA-Case-LAR-14145-1; NAS 1.71:LAR-14145-1; US-Patent-Appl-SN-508316) Avail: NTIS HC A03/MF A01 CSCL 11C

Polyimidazoles (PI) are prepared by the aromatic nucleophilic displacement reaction of di(hydroxyphenyl) imidazole monomers with activated aromatic dihalides or activated aromatic dinitro compounds. The reactions are carried out in polar aprotic solvents such as N,N-dimethyl acetamide, sulfolane, N-methylpyrrolidinone, dimethylsulfoxide, or diphenylsulfone using alkali metal bases such as potassium carbonate at elevated temperatures under nitrogen. The di(hydroxyphenyl) imidazole monomers are prepared by reacting an aromatic aldehyde with a dimethoxybenzil or by reacting an aromatic dialdehyde with a methoxybenzil in the presence of ammonium acetate. The di(methoxyphenyl) imidazole is subsequently treated with aqueous hydrobromic acid to give the di(hydroxphenyl) imidazole monomer. This synthetic route has provided high molecular weight PI of new chemical structure, is economically and synthetically more favorable than other routes, and allows for facile chemical structure variation due to the availability of a large variety of activated aromatic dihalides and dinitro compounds. NASA

N90-26955*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.

A TOUGH PERFORMANCE SIMULTANEOUS SEMI-INTERPENETRATING POLYMER NETWORK Patent Application

Ruth H. Pater, inventor (to NASA) 2 Nov. 1989 31 p (NASA-Case-LAR-14339-1; NAS 1.71:LAR-14339-1; US-Patent-Appl-SN-430470) Avail: NTIS HC A03/MF A01 CSCL 11C

A semi-interpenetrating polyimide (semi-IPN) network and methods for making and using the same are disclosed. The semi-IPN system comprises a high performance thermosetting polyimide having an acetylene-terminated group acting as a crosslinking site and a high performance linear thermoplastic polyimide. The polymer is made by combining low viscosity precursors and low molecular weight polymers of the thermosetting and thermoplastic polyimides and allowing them to react in the immediate presence of each other to form a simultaneous semi-interpenetrating polyimide network. Provided is a high temperature system having significantly improved processability and damage tolerance while maintaining excellent thermo-oxidative stability, mechanical properties and resistance to humidity, when compared with the commercial high temperature resin, Thermid 600. This material is particularly adapted for use as a molding, adhesive and advanced composite matrix for aerospace structural and electronic applications. NASA

N90-26956*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.

AROMATIC POLYIMIDES CONTAINING A DIMETHYLSILANE-LINKED DIANHYDRIDE Patent Application

Anne K. St.Clair, inventor (to NASA), Terry L. St.Clair, inventor (to NASA), and J. Richard Pratt, inventor (to NASA) (PRC Kentron, Inc., Hampton, VA.) 12 Dec. 1989 12 p (NASA-Case-LAR-14198-1; NAS 1.71:LAR-14198-1; US-Patent-Appl-SN-449210) Avail: NTIS HC A03/MF A01 CSCL 11C

A high-temperature stable, optically transparent, low dielectric aromatic polyimide is prepared by chemically combining equimolar quantities of an aromatic dianhydride reactant and an aromatic diamine reactant, which are selected so that one reactant contains at least one Si(CH3)2 group in its molecular structure, and the other reactant contains at least one -CF3 group in its molecular structure. The reactants are chemically combined in a solvent medium to form a solution of a high molecular weight polyamic acid, which is then converted to the corresponding polyimide. NASA

N90-26957# Argonne National Lab., IL. Materials and Components Technology Div.

AN INITIAL COMPARISON BETWEEN TWO 3-D x RAY CT ALGORITHMS FOR CHARACTERIZING

P. Rizo (Commissariat a l'Energie Atomique, Grenoble, France) and W. A. Ellingson Jun. 1990 6 p Presented at the Conference on Nondestructive Evaluation of Modern Ceramics, Columbus, OH, 9-12 Jul. 1990; cosponsored by American Ceramic Society and American Society for Nondestructive Testing (Contract W-31-109-eng-38) (DE90-013656; CONF-900736-2) Avail: NTIS HC A02/MF A01

The objective of using an x ray tomographic instrument for any application is to view a cross-sectional image of an object by noninvasive, nondestructive means in order to detect density variations, inclusions etc. Because ceramic materials, in general, have low fracture toughness, single tomographic images of an object are likely not to provide the information necessary for predicting failure of complex objects such as turbo charger rotors, valves, scrolls and other typical structural ceramic components. Tomographic imaging using 3-D systems becomes a solution for total ceramic object interrogation provided that algorithms can be developed which do not introduce significant artifacts which could lead to false interpretations or geometric distortion. In addition, because of the necessity in ceramics to detect small features, the source of x rays needs to be very small, to allow geometric magnification, now achievable by use of state-of-art microfocus systems. The purpose of this paper is to present an initial comparison of image reconstructions on ceramic parts using a 3-D tomography system using two different 3-D reconstruction algorithms. We will stress mainly differences in density measurements as opposed to geometrical measurements. DOE

N90-26958# Virginia Polytechnic Inst. and State Univ., Blacksburg. Polymer Materials and Interfaces Lab.

ELASTOMERS AND OTHER ORGANIC COMPOSITES Final Report, 16 Jul. 1984 - 31 Oct. 1988

James E. McGrath, Garth L. Wilkes, Thomas C. Ward, and Donald G. Baird 28 May 1990 10 p (Contract DAAG29-84-K-0091) (AD-A222772; ARO-21527.22-CH) Avail: NTIS HC A02/MF A01 CSCL 05/2

The objective of this program was to bring together four investigators whose expertise was in the area of polymer synthesis, characterization, rheology and processing, solid state morphology and mechanical behavior. Another objective is to integrate these efforts toward the synthesis of new elastomers and polymeric matrix resins suitable for organic composites. The abstract describes some highlights of research findings and potential applications. In addition, in an appendix we have included statistics on publications, preprints, and M.S. and Ph.D. Theses supported by this contract. GRA

N90-26959# Case Western Reserve Univ., Cleveland, OH.

MOLECULAR DYNAMICS OF PHYSICAL AGING PROCESSES IN POLYMER GLASSES (EXPERIMENT AND THEORY) Final Report, 1 Sep. 1986 - 31 Jan. 1990

John D. McGervey 16 Apr. 1990 4 p (Contract DAAL03-86-K-0166) (AD-A222848; ARO-23926.2-MS) Avail: NTIS HC A01/MF A01 CSCL 07/6

Free volume and aging were studied in PVAc (Polyvinyl Acetate), PMMA (Polymethyl Methacrylate), PEMA (Polyethylene Methacrylate), and polycarbonates by fluorescence spectroscopy, Electron Spin Resonance (ESR), and Positron Annihilation Spectroscopy (PAS). The product of the ortho-positronium (o-Ps) lifetime Tau 3 and its formation probability I3 has a temperature dependence above T(g) that follows that of the total free volume. The product I3 Tau 3 shows a significant decrease as a function of time at temperatures below T(g). Some specimens with the same composition and the same free volume yielded different values for the individual factors I3 and Tau 3. This indicates that PAS can distinguish between samples that are indistinguishable by conventional methods. Preliminary results were obtained on

simultaneous measurement of the positron lifetime and the momentum of the annihilated positron-electron pair. There is a clear difference between high-momentum and low-momentum lifetime distributions, with a much larger value of I3 for the high momentum curve. This is what one expects from the higher momentum involved in o-Ps annihilation. GRA

N90-26960# Dayton Univ., OH. Research Inst.
DYNAMIC PROPERTIES OF POROUS B4C Interim Report
N. S. Brar, Z. Rosenberg, and S. J. Bless 25 Jan. 1990 24 p
(Contract DAAL03-88-K-0203)
(AD-A222850; UDR-TM-89-15; ARO-26169.1-MS-A) Avail: NTIS HC A03/MF A01 CSCL 07/2

The sound speed in porous B4C (Boron Carbide) was measured and predicted on the basis of a spherical void model and a penny crack model. Neither model does well for porosity exceeding 10 percent. Measured values of Hugoniot elastic limit for porous B4C agree well with those predicted by the Steinberg's model. Measured transverse stress in the elastic range of B4C under 1-d strain condition agrees with the predictions. GRA

N90-26961# Harvard Univ., Cambridge, MA. Div. of Applied Sciences.
THEORY OF CERAMIC/ZIRCONIA COMPOSITES: TOUGHENING, STRENGTHENING, AND SYNERGISM
Bernard Budiansky and D. M. Stump Apr. 1990 11 p Presented at the 7th World Ceramics Congress and Satellite Symposia, Montecatini, Terme, Italy, Jun. 1990 Sponsored in part by NSF
(Contracts N00014-86-K-0753; N00014-84-K-0510)
(AD-A222931; MECH-159) Avail: NTIS HC A03/MF A01 CSCL 11/2

A review is given of recent theoretical results concerning toughening and strengthening in brittle ceramics reinforced with dilatantly transforming zirconia particles. Small-scale analysis of long dominant cracks provides resistance curves that exhibit peak fracture toughnesses for finite amounts of crack growth. Similar results for the tensile fracture strengths of short cracks have implications for transformation strengthening. The interaction due to the presence of both transforming particles and ductile metal particles can result in synergistic reinforcing effects over a parametric range of material properties. GRA

N90-26962# Army Materials Technology Lab., Watertown, MA. Polymer Research Branch.
SOLUBILITY CHARACTERISTICS OF A METHACRYLATE COPOLYMER Final Report
Marie K. Potts May 1990 33 p Sponsored by Army Lab. Command, Adelphi, MD
(AD-A222938; MTL-TR-90-28) Avail: NTIS HC A03/MF A01 CSCL 07/6

Solubility maps in several coordinate systems have been constructed to determine regions of solubility for a methacrylate copolymer. The general methodology followed was that of ASTM D 3132 Test Method for Solubility Range of Resins and Polymers. Over 90 individual solvents and solvent mixtures were tested as solvents for the copolymer in the concentration range 5 to 7.5 percent w/v. A database on the solubility characteristics of common solvents was created to store and utilize the information. Solvent maps were formulated using the solubility parameter system, and the Teas fractional cohesion parameter system. Each system is primarily empirical in nature, but has varying degrees of theoretical justification. GRA

N90-26963*# National Materials Advisory Board, Washington, DC.
STATUS AND APPLICATIONS OF DIAMOND AND DIAMOND-LIKE MATERIALS: AN EMERGING TECHNOLOGY Report,for 1987 - 1990
30 Apr. 1990 114 p Sponsored by NASA, Washington
(Contract MDA903-89-K-0078)
(NASA-CR-186935; NAS 1.26:186935; AD-A222986; NMAB-445; LC-90-60384; ISBN-0-309-04196-1) Avail: NTIS HC A06/MF A01 CSCL 08/7

Recent discoveries that make possible the growth of crystalline diamond by chemical vapor deposition offer the potential for a wide variety of new applications. This report takes a broad look at the state of the technology following from these discoveries in relation to other allied materials, such as high-pressure diamond and cubic boron nitride. Most of the potential defense, space, and commercial applications are related to diamond's hardness, but some utilize other aspects such as optical or electronic properties. The growth processes are reviewed, and techniques for characterizing the resulting materials' properties are discussed. Crystalline diamond is emphasized, but other diamond-like materials (silicon carbide, amorphous carbon containing hydrogen) are also examined. Scientific, technical, and economic problem areas that could impede the rapid exploitation of these materials are identified. Recommendations are presented covering broad areas of research and development. GRA

N90-26964# Chemical Research and Development Center, Aberdeen Proving Ground, MD.
WEAR METAL ANALYSIS IN ENGINE OIL BY MICROWAVE DIGESTION AND ATOMIC ABSORPTION SPECTROSCOPY Final Report, Aug. 1987 - Jan. 1988
William T. Muse, Jr. May 1990 14 p
(AD-A223070; CRDEC-TR-167) Avail: NTIS HC A03/MF A01 CSCL 11/8

Digestion procedures are described for the analysis of wear metals in National Bureau of Standards (NBS) oil samples by a closed vessel microwave digestion system. Samples were analyzed by flame atomic absorption spectroscopy. Recoveries of Al, Fe, Ni, Cu, and Pb in the 300-ppm NBS oil ranged from 98 to 103 percent with standard deviations from 3 to 14 percent. This method serves as a relatively quick matrix destruction technique for the quantitation of metals in oil. GRA

N90-26965# Cincinnati Univ., OH. Dept. of Materials Science and Engineering.
CHARACTERIZATION OF POLYMER INTERPHASES USING SURFACE-ENHANCED RAMAN SCATTERING
F. J. Boerio, J. T. Young, and W. H. Tsai 1 Jun. 1990 3 p Presented at the Materials Research Society, San Francisco, CA, 16-20 Aprl. 1990
(Contract N00014-89-J-1590)
(AD-A223103; TR-9) Avail: NTIS HC A01/MF A01 CSCL 07/6

Surface-enhanced Raman scattering (SERS) and reflection-absorption infrared spectroscopy (RAIR) were used to determine the molecular structure of interphases between ploymers and metal substrates. An interesting example was provided by pyromellitic diimide (PMDI), a model compound for polyimides, and silver substrates. Normal Raman spectra of PMDI were characterized by strong bands near 1772, 1370, 760, and 655 1/cm and medium intensity bands near 1630 and 1205 1/cm were weak in SERS spectra obtained from films of PMDI spin-coated onto silver island films while those near 1370 and 1205 1/cm and a new band near 685 1/cm were strongest. Differences between the normal Raman and SERS spectra were related to orientation effects indicating that PMDI was absorbed onto silver with a vertical conformation in which the rings were perpendicular to the surface and one imide group was in contact with the surface. GRA

N90-26966# Cincinnati Univ., OH. Dept. of Materials Science and Engineering.
CHARACTERIZATION OF PMDI/HOPG INTERFACES BY SERS USING A SILVER OVERLAYER CONFIGURATION Technical Report No. 10
W. H. Tsai and F. J. Boerio 1 Jun. 1990 3 p Presented at the 13th Annual Meeting of the Adhesion Society, Savannah, GA, 18-21 Feb. 1990
(Contract N00014-89-J-1590)
(AD-A223104; TR-10) Avail: NTIS HC A01/MF A01 CSCL 11/9

Surface-enhanced Raman scattering (SERS) was used for

characterization of model fiber/polyimide interfaces. Pyromellitic diimide (PMDI) was used as a model polyimide while highly oriented pyrolytic graphite (HOPG) was viewed as a model graphite fiber. Samples for SERS were prepared by depositing films of PMDI onto HOPG and then depositing silver island films on top of the PMDI. When the PMDI films were relatively thick (85 A), the SERS spectra were similar to normal Raman spectra of bulk PMDI. These spectra were characterized by the imide bands near 1775, 1748, 1368, and 659 1/cm and by the benzene ring bands near 1633, 1200, 762, 578, and 520 1/cm, respectively. GRA

N90-26967# Cincinnati Univ., OH. Dept. of Materials Science and Engineering.
NON-DESTRUCTIVE CHARACTERIZATION OF POLYMER/METAL INTERFACES USING SURFACE-ENHANCED RAMAN SCATTERING (SERS) Technical Report No. 8
F. J. Boerio 1 Jun. 1990 3 p Presented at the International Conference on Adhesion and Surface Analysis, Loughborough, England, 3-5 Apr. 1990
(Contract N00014-89-J-1590)
(AD-A223105; TR-8) Avail: NTIS HC A01/MF A01 CSCL 07/6

Surface-enhanced Raman scattering (SERS) is an analytical technique in which the Raman scattering cross-sections of molecules adsorbed onto the roughened surfaces of certain metals are enhanced by as much as six orders of magnitude compared to their value for normal Raman scattering. Many models have been proposed to explain SERS, but it is now considered that most of the enhancement is related to two mechanisms. The first is associated with the large electric fields that can be induced at the surfaces of metal particles having small radii of curvature. The second is associated with formation of charge-transfer complexes between the adsorbed molecules and the substrate. Enhancement due to the charge transfer mechanism is obtained only for molecules immediately adjacent to the surface, but enhancement due to electromagnetic mechanism may extend several monolayers away from the surface. Considering that normal Raman scattering by polymers is weak and that scattering by molecules adjacent to the substrate is strongly enhanced, it is evident that SERS can be used for non-destructive characterization of interfaces between polymer films and metals as long as the films are not so thick that scattering by the bulk of the film is comparable in intensity to SERS from the interface. GRA

N90-26968# University of Southern Mississippi, Hattiesburg. Dept. of Polymer Science.
RADICAL HOMOPOLYMERIZATION OF A TRISUBSTITUTED ALKENE: 1-CYCLOBUTENECARBOXYLIC ACID AND ITS POLYMER Technical Report No. 35, 1 Jun. 1989 - 31 May 1990
Paul K. Casey and Lon J. Mathias 18 Jun. 1990 15 p Submitted for publication
(Contract N00014-89-J-1225)
(AD-A223188) Avail: NTIS HC A03/MF A01 CSCL 07/6

Unexpected formation of an insoluble polymer during purification of 1-cyclobutenecarboxylic acid led to solid state 13C NMR characterization which seemed to indicate vinyl polymerization was occurring. Deliberate attempts to induce radical polymerization involved photoinitiation with 2,2-dimethyoxy 2-phenylacetophenone (Irgacure 651) in N,N-dimethylformamide (DMF) or tetrahydrofuran (THF) to give a product that was soluble in dimethylsulfoxide (DMSO) and very soluble in aqueous base. Spectral characterization with 13C NMR in solution (DMSO-d(6)) and CP/MAS confirmed vinyl polymerization and the presence of pendent carboxylic acid groups. Notably absent were peaks due to ester linkages and backbone or pendent unsaturation. Intrinsic viscosities of the potassium salt of the polymer in pure water and in 1 N aqueous NaCl were ca 2.25 grams per deciLiters and 0.27 g/dL, respectively, consistent with a polyelectrolyte effect in water and a reasonable molecular weight. GRA

N90-26969# Minnesota Univ., Minneapolis. Dept. of Chemical Engineering and Materials Science.
DIFFUSION OF PENETRANTS IN POLYMERS Final Report, 3 Feb. 1986 - 1 Feb. 1990
Matthew Tirrell, Theodore S. Frick, and Timothy P. Lodge 7 May 1990 2 p
(Contract DAAL03-86-G-0034)
(AD-A223217; ARO-23781.4-CH-F) Avail: NTIS HC A01/MF A01 CSCL 07/6

Much effort has been expended in trying to understand and predict the unusual phenomena which can occur when initially glassy polymers are exposed to small-molecule gases, organic vapors or liquids. Sorption of the gas or vapor seems to occur at two distinctly different sorption sites (dual mode sorption), and influx of the penetrant leads to a non-Fickian front traveling at constant velociy (case-II diffusion). Because traditional measurement techniques such as sorption and permeation are complicated by these very phenomena which they try to explain, attempts to determine to what extent these very phenomena which they try to explain, attempts to determine to what extent these phenomena are governed by diffusive characteristics of glassy transport rather than by the interplay of diffusion and polymer relaxation have been frustrated. Instead, a method of observing diffusion which does not require penetrant transport across a surface and influx into the sample must be used. GRA

N90-26970# Corning Glass Works, NY.
ADVANCED CERAMIC ARMOR MATERIALS Final Report, 15 Aug. - 31 Dec. 1989
Sandra L. Hagg, Thomas D. Ketcham, Pamela C. Merkel, and LeRoy S. Share 11 May 1990 74 p
(Contract DAAL03-89-C-0015)
(AD-A223227; ARO-27017.1-MS-A) Avail: NTIS HC A04/MF A01 CSCL 11/2

This report describes the research completed by Corning Incorporated under the U.S. Army Research Office contract DAAL03-89-C-0015. The purpose of this program was to develop improved low-cost ceramic materials and processing technology for advanced armor systems, specifically for use in heavy vehicle armor to defeat long rod kinetic energy threats. Several toughened alumina targets were fabricated and characterized. Ballistic evaluation was completed by the Southwest Research Institute. GRA

N90-26971*# National Materials Advisory Board, Washington, DC. Commission on Engineering and Technical Systems.
LIQUID CRYSTALLINE POLYMERS Report, 1987 - 1990
28 Feb. 1990 120 p Sponsored in part by NASA, Washington
(Contract MDA903-89-K-0078)
(NASA-CR-186949; NAS 1.26:186949; AD-A223253; NMAB-453; LC-90-60385; ISBN-0-309-04231-3) Avail: NTIS HC A06/MF A01 CSCL 07/4

The remarkable mechanical properties and thermal stability of fibers fabricated from liquid crystalline polymers (LCPs) have led to the use of these materials in structural applications where weight savings are critical. Advances in processing of LCPs could permit the incorporation of these polymers into other than uniaxial designs and extend their utility into new areas such as nonlinear optical devices. However, the unique feature of LCPs (intrinsic orientation order) is itself problematic, and current understanding of processing with control of orientation falls short of allowing manipulation of macroscopic orientation (except for the case of uniaxial fibers). The current and desirable characteristics of LCPs are reviewed and specific problems are identified along with issues that must be addressed so that advances in the use of these unique polymers can be expedited. GRA

N90-26972# NSI Technology Services Corp., Dayton, OH.
THE ACUTE, DELAYED NEUROTOXICITY EVALUATION OF TWO JET ENGINE OIL FORMULATIONS Final Report, May - Oct. 1989
E. R. Kinkead, S. R. Bunger, R. E. Wolfe, and H. G. Wall Apr. 1990 25 p

(Contract F33615-85-C-0532; AF Proj. 6302)
(AD-A222018; AAMRL-TR-90-018; NMRI-90-16) Avail: NTIS HC A03/MF A01 CSCL 06/11

This study was designed to determine the potential of two jet oils to produce acute, delayed neurotoxicity. The hydrocarbon-based ester oil formulation contained 3 percent tricresyl phosphate isomers, including triorthocresyl phosphate (TOCP) in one of the formulations. Hens were orally dosed over a five-day period and then observed for a total period of 30 days. All TOCP-positive control hens demonstrated signs of acute, delayed neurotoxicity. Hens from both jet engine oil groups remained asymptomatic throughout the observation period. No neurotoxic hazard would be expected for military or civilian personnel involved in the manufacture, transportation, or handling of these compounds. GRA

N90-26973# Northwestern Univ., Evanston, IL. Center for Quality Engineering and Failure Prevention.
MICROMECHANICS OF INTERFACES IN HIGH TEMPERATURE CERAMICS Annual Report No. 1, FY 1989 - FY 1990
Toshio Mura, John O. Brittain, and Katherine Faber 28 Feb. 1990 58 p
(Grant AF-AFOSR-0269-89; AF Proj. 2302)
(AD-A222027; NU-CENTER-QEFP-0650-350-R402; AFOSR-90-0571TR) Avail: NTIS HC A04/MF A01 CSCL 11/2

Results of the initial phase of a program to investigate the micromechanics of interfaces are summarized. Model experiments have been devised and implemented to follow crack propagation in a fiber reinforced transparent matrix by visual observations and electrical resistance of the fiber. In addition, pull-out tests on the same composites have been carried out with several matrix-fiber interface modifications. Some success has been achieved in separating debonding and frictional components at the interface. We also report on the very early stage of experiments that have been initiated to study the in situ debonding behavior during pull-out in a ceramic composite by utilizing a photo-elastic technique. GRA

N90-26974# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Chemical Engineering.
STRUCTURE-PROPERTY BEHAVIOR OF NEW ORGANIC-INORGANIC POLYMERIC HYBRID MATERIALS BASED ON SOL GEL CHEMISTRY End of the Year Report
Garth L. Wilkes May 1990 10 p
(Contract N00014-88-K-0007)
(AD-A222168) Avail: NTIS HC A02/MF A01 CSCL 11/4

The purpose of this work has been to synthesize and characterize the structure-property response of new inorganic-organic hybrid materials that incorporate functionalized organic oligomers with metal alkoxides through the use of sol gel reactions. These systems, which have been termed ceramers as a result of their possessing properties of both ceramic-like materials (inorganic glasses) as well as organic polymers, can vary significantly in their properties due to altering the amount of respective metal alkoxide species relative to the functionalized organic components which may be oligomeric or even of lower molecular weight. The hope is this approach will lead to new hybrid network materials with unique properties. In many instances, the characterization of these materials as well as some of their mechanical, optical and electronic properties have been investigated. GRA

N90-26975# Rensselaer Polytechnic Inst., Troy, NY. Dept. of Chemistry.
MISCIBILITY AND PHASE BEHAVIOR OF POLY (ENAMINONITRILE)/PEO BLENDS
J. A. Moore and Ji Heung Kim 31 May 1990 5 p Submitted for publication
(Contract N00014-85-K-0632)
(AD-A222255; TR-20) Avail: NTIS HC A01/MF A01 CSCL 07/6

Recently, poly(enaminonitriles) was synthesized and characterized. It is a novel class of polymers which exhibit the thermal stability of aramides but are readily soluble in simple, volatile solvents such as THF and diglyme, as well as in polar, aprotic solvents. Spectroscopic evidence supports specific hydrogen bonded interactions between the NH-groups of the enaminonitrile unit and the oxygen atoms in the ether. Ether solutions exhibit lower critical solution temperature behavior. For the glymes, the critical temperature for phase separation increases as the number -CH2-CH2-O- units increases from one to eleven. A similar tendency is observed for blends with poly(ethyleneoxide) up to PEO contents of 50 wt percent. DSC, FT-IR and light scattering data are presented and discussed. GRA

N90-26976# Army Natick Research and Development Command, MA.
LABORATORY EVALUATION OF TWO NEW HIGH-PERFORMANCE POLYESTER BATTING INSULATION MATERIALS Final Report, May 1989 - Mar. 1990
Phillip W. Gibson May 1990 51 p
(AD-A222291; NATICK/TR-90/030) Avail: NTIS HC A04/MF A01 CSCL 11/2

Two synthetic insulating materials developed for military clothing and sleeping bags by Albany International Research Co. (AIRC) were evaluated by the U.S. Army Natick RD and E Center (Natick). The materials consist of polyester fiber in two forms: a bonded staple-fiber batt, and a spread continuous filament tow. The materials were evaluated for thermal, compressive, and water repellent properties. Laundering durability was also assessed. A commercially available synthetic insulation and waterfowl down were evaluated at the same time to allow a direct comparison. The bonded stable fiber insulation performed very well in all laboratory testing, but suffered a significant degradation in properties after 10 cycles of military field laundering. The continuous filament insulation performed well in all areas except for deficiencies in water repellent properties. The continuous filament insulation suffered less of a degradation from military field laundering than the bonded staple fiber insulation. GRA

N90-26977# Akron Univ., OH. Inst. of Polymer Engineering.
MODEL STUDIES OF THE EFFECT OF SURFACE ROUGHNESS AND MECHANICAL INTERLOCKING ON ADHESION
A. N. Gent and C.-W. Lin May 1990 38 p Submitted for publication
(Contract N00014-85-K-0222)
(AD-A222402; TR-25) Avail: NTIS HC A03/MF A01 CSCL 11/1

The apparent strength of adhesion was measured for a soft elastic layer adhering to model porous substrates, consisting of rigid plates containing regular arrays of cylindrical holes. Two contributions to the apparent strength were identified and compared with the predictions of a simple theoretical treatment. The first is adhesion to the surface itself. Because rough surfaces have greater area for bonding, the strength of adhesion was increased by as much as twenty-fold. The second arises from the work of breaking deeply embedded or entangled strands in order to detach the overlayer. Contributions from this mechanism were as much as several hundred times the (low) intrinsic strength of adhesion. Satisfactory agreement was obtained with theory in both cases. Measurements were also made using cloth substrates, when the adhering layer penetrated the cloth completely. The work of detaching and breaking permeating strands was again much larger than the intrinsic strength of adhesion, in reasonable agreement with theoretical predictions. GRA

N90-26978# Rockwell International Corp., Thousand Oaks, CA. Science Center.
ENVIRONMENTAL INTEGRITY OF COATING/METAL INTERFACE Final Report, 1 Mar. 1987 - 31 Jan. 1990
M. Kendig, R. Addison, J. Lumsden, P. Stocker, S. Jeanjaquet, and D. Anderson Apr. 1990 60 p
(Contract N00014-87-C-0075)

(AD-A222426; SC5508.FR) Avail: NTIS HC A04/MF A01 CSCL 11/3

The role of chemical electrochemical reactions at the coating/metal interface in the region of a cathodic disbond in degrading adhesion of organic coatings to steel has been studied using scanning acoustic microscopy, wetting analysis and x ray photo-electron spectroscopy (XPS). The results show that cathodic polarization accelerates adhesion loss by the combined effects of a shift in the zeta potential of the steel substrate and build-up of an alkaline sodium hydroxide electrolyte that chemically degrades the polymer. Cathodic formation of sodium hydroxide not only degrades the polymer, but also lowers the surface tension of the electrolyte so as to favor displacement of the polymer. A mechanism of interfacial bond rupture made irreversible by polymer degradation is proposed. GRA

N90-26979# Cincinnati Univ., OH. Dept. of Materials Science and Engineering.

CHARACTERIZATION OF MODEL POLYIMIDE/SILVER INTERPHASES USING SURFACE-ENHANCED RAMAN SCATTERING

W. H. Tsai, J. T. Young, F. J. Boerio, and P. P. Hong 1 Jun. 1990 48 p Submitted for publication

(Contract N00014-89-J-1590)

(AD-A222488; TR-5) Avail: NTIS HC A03/MF A01 CSCL 11/9

Surface-enhanced Raman scattering (SERS) was used to investigate the adsorption of model compounds for polyimides onto silver island films and onto highly oriented pyrolytic graphite (HOPG). SERS spectra of pyromellitic diimide (PMDI) adsorbed onto silver island films were mostly independent of the thickness of the PMDI films, confirming the SERS is an interfacial rather than bulk effect and that SERS can be used to examine the interface between an adsorbed film and a metal substrate without interference from normal Raman scattering by the bulk of the film. Differences in the relative intensities of several bands in the normal Raman and SERS spectra of PMDI adsorbed onto silver island films were related to orientation effects. It was concluded that most molecules were physisorbed with a vertical configuration in which the plane of the molecules was perpendicular to the surface and one imide group was adjacent to the surface. GRA

N90-26980# Cincinnati Univ., OH. Dept. of Materials Science and Engineering.

NON-DESTRUCTIVE CHARACTERIZATION OF POLYMER/METAL INTERPHASES USING SURFACE-ENHANCED RAMAN SCATTERING

F. J. Boerio, P. P. Hong, W. H. Tsai, and J. T. Young 1 Jun. 1990 39 p Submitted for publication

(Contract N00014-89-J-1590)

(AD-A222490; TR-6) Avail: NTIS HC A03/MF A01 CSCL 11/9

Surface enhanced Raman scattering (SERS) is an analytical technique in which the Raman scattering cross sections of molecules adsorbed onto the roughened surfaces of certain metals are enhanced by as much as six orders of magnitude compared to their value for normal Raman scattering. The mechanisms are associated with the large electric fields that can be induced at the surfaces of metal particles having small radii of curvature and with formation of charge transfer complexes between the adsorbed molecules and the substrate. Enhancement due to the charge transfer mechanism is obtained only for molecules immediately adjacent to the surface but enhancement due to the electromagnetic mechanism may extend several monolayers away from the surface. Since normal Raman scattering by polymers is weak and scattering by molecules adjacent to the substrate is strongly enhanced, SERS can be used for nondestructive characterization of interfaces between polymer films and metals. GRA

N90-26981# Naval Surface Warfare Center, Silver Spring, MD. Dept. of Research and Technology.

SYNTHESIS OF ENERGETIC SINGLE PHASE AND MULTI-PHASE POLYMERS Annual Progress Report, 1 Jan. - 31 Dec. 1989

H. G. Adolph, L. A. Nock, and J. M. Goldwasser 31 Mar. 1990 64 p

(Contracts N00014-89-WX-24052; N00014-89-WX-2C010)

(AD-A222491) Avail: NTIS HC A04/MF A01 CSCL 07/6

Several polyformals of novel fluorodiols and fluoronitrodiols provided by Fluorochem, Inc. were prepared. The previously prepared polyformal of tetranitrodioxatridecanediol was obtained with a molecular weight up to 10,000. This soft block has a TG of -11 C. The synthesis of poly(azidoacetals) as potential soft blocks was initiated. The first example successfully synthesized was the polyazidoacetal of 1,6-hexanediol. New monofunctional, isocyanate terminated hard blocks with estimated melting points of 50 to 100 C were synthesized, including the 1:1 adduct of docosanol and toluene diisocyanate (TDI). GRA

N90-26982# Virginia Polytechnic Inst. and State Univ., Blacksburg. Center for Adhesive and Sealant Science.

AN INTERDISCIPLINARY APPROACH TO THE PREDICTIVE MODELING OF STRUCTURAL ADHESIVE BONDING Final Report, 1983 - 1989

H. F. Brinson, D. W. Dwight, J. N. Reddy, Thomas C. Ward, and J. P. Wightman 1989 11 p

(Contract N00014-82-K-0185)

(AD-A221703) Avail: NTIS HC A03/MF A01 CSCL 11/1

Topics addressed included: mechanics of adhesive joints; surface and interphase modification and analysis; stress analysis of adhesive joints by the finite element method; stress durability testing of thermoplastic/titanium adhesive bonds in severe environments; and adherend surface characterization absorption. GRA

N90-26983# Spire Corp., Bedford, MA.

SELF-LUBRICATING-DIAMOND LIKE COATINGS DEPOSITION Final Report, 20 Nov. 1986 - 28 Mar. 1989

James Hirvonen and Ward Halverson Dec. 1989 52 p

(Contract F33615-87-C-5203; AF Proj. 3005)

(AD-A221756; FR-10102; WRDC-TR-89-4119) Avail: NTIS HC A04/MF A01 CSCL 11/3

Ion beam enhanced deposition (IBED) was used to deposit hard, adherent thin films of boron nitride with a significant cubic crystal structure present. A number of analytical techniques were used to characterize these coatings including X ray photoelectron spectroscopy (XPS); X ray diffraction (XRD); transmission electron microscopy (TEM); Raman spectroscopy; nuclear radiation analysis (NRA); Rutherford backscattering spectroscopy (RBS); and IR spectroscopy. Friction and wear behavior of these coatings was also conducted. The IBED-i-BN thin films generally exhibit a high microhardness and good adhesion to the silicon and 304 stainless steel substrates. All films (except one) had the hyperstoichiometric boron concentration. The ration Boron/Nitride approached the theoretical value at the highest current densities of the nitrogen beam. Many of the i-BN coatings exhibited low friction against 440 C stainless steel and Silicon nitride counterfaces. Friction seems to increase with increasing B/N ratios. There is a strong demand for diamond-like coatings of boron nitride (BN) in a large number of tribological applications including cryogenic bearings and adiabatic engines. Commercial use of BN coatings was previously impeded by sample to sample reproducibility problems which have been overcome by the innovative Spire process using ion beam enhanced deposition (IBED). GRA

N90-26984# Hebrew Univ., Jerusalem (Israel). Dept. of Inorganic and Analytical Chemistry.

PREPARATION AND CHARACTERIZATION OF THIN FILMS BASED ON SOL-GEL TECHNIQUE AND DEVELOPMENT OF SPECTROSCOPIC PROBE FOR FILM FORMATION AND CHARACTERIZATION Final Report, 1 Jul. 1987 - 15 Jul. 1989

Renata Reisfeld 1 Dec. 1989 41 p

(Grant AF-AFOSR-0269-87)
(AD-A221762; EOARD-TR-90-05) Avail: NTIS HC A03/MF A01 CSCL 09/3

Thin glass films prepared by the sol-gel method were deposited on glass supports. Divalent cobalt and divalent copper were used as optical probes for changes in the glass formation and re-arrangement of the silicate groups during the heat-treatments whereby the cobalt ion initially octahedrally coordinated was transformed into lower coordination as a result of elimination of water and increase of density of the glass. Divalent copper is also effective in infrared absorption and silver particles embedded in the films form narrow-band absorbing filters. Characterization of surfaces of thin films applied in coatings for lasers and laser windows is important in understanding and preventing damage of these materials. GRA

N90-26985# Wright Research Development Center, Wright-Patterson AFB, OH. Structural Materials Branch.
A CHARACTERIZATION OF V-391/H46-8B, A TOUGHENED BMI PREPREG SYSTEM PRODUCED BY US POLYMERIC Final Report, Jul. - Sep. 1989
Charles S. Hill Feb. 1990 42 p
(AF Proj. 2419)
(AD-A221772; WRDC-TR-90-4022) Avail: NTIS HC A03/MF A01 CSCL 07/2

The objective of this research effort is to characterize an advanced composite prepreg system. The material under investigation is U.S. Polymeric's V-391, a modified bismaleimide (BMI) resin, on continuous Hitex 46-8B graphite fibers. U.S. Polymeric has stated that the V-391 resin has the toughness of thermoplastics and the temperature performance of BMI's (Konarski 89). This study shows that although V-391/H46-8B shows improved toughness over baseline BMI's, its toughness is only a fraction of that of current thermoplastics, but its processability makes it an attractive material over baseline BMI's. GRA

N90-26986# Naval Air Development Center, Warminster, PA. Air Vehicle and Crew Systems Technology Dept.
UNICOAT: DEVELOPMENT OF A PRIMER/TOPCOAT AND FLEXIBLE PRIMER FOR ALUMINUM Report, Oct. 1984 - Sep. 1986
Charles R. Hegedus, Anthony T. Eng, and Donald J. Hirst 30 Mar. 1990 329 p
(AD-A221803) Avail: NTIS HC A15/MF A02 CSCL 11/3

Two corrosion preventive organic coatings were developed for use on aluminum and specifically for application on Navy aircraft. They provide two alternatives for improving aircraft paint systems. The first coating can be applied directly to an aluminum substrate and perform as a self-priming topcoat. It consists of a two component, aliphatic polyurethane binder with titanium dioxide, zinc molybdate, zince phosphate, an organo-zinc salt, and titanium dioxide vesiculated bead pigments. This primer/topcoat meets or exceeds all of the critical performance requirements of the current Navy aircraft paint system; Mil-P-23377 epoxy primer and Mil-C-83286 polyurethane topcoat. It exhibits good adhesion, corrosion inhibition, flexibility, chemical and weather resistance. The primer/topcoat has been formulated in lusterless gray colors common on Navy tactical aircraft. The volatile organic content (VOC) of the primer/topcoat prior to thinning is 395 grams of organic solvent per liter of paint. The VOC after thinning with 1.1.1 trichloroethane, which is currently an exempt solvent, to a viscosity compatible with conventional air spray, is 295 grams/liter. GRA

N90-26987# Wright Research Development Center, Wright-Patterson AFB, OH. Polymer Branch.
COMPRESSIVE STRENGTH OF RIGID-ROD POLYMER FIBERS Interim Report, Apr. - Dec. 1989
Charles Y-C. Lee and U. Santhosh (Adtech Systems Research, Inc., Dayton, OH.) Mar. 1990 52 p
(AF Proj. 2303)
(AD-A221886; WRDC-TR-90-4023) Avail: NTIS HC A04/MF A01 CSCL 07/6

Various mechanical models describing the buckling of a single column and a bundle of columns were reviewed. The relationship between these models and the buckling of a polymeric fiber with substructures (fibril, microfibril, and individual chain) were discussed. It was found that the structural element that has the lowest critical buckling strength will initiate the compressive failure of the fiber. The critical strength is dependent on the element geometry and the strength of the interaction with the neighbors. In previous analysis in the literature, the equations were applied to the molecular chain level. This study shows that the analysis is more appropriate at the fibril level. This can account for the failure of many attempts in improving the compressive strength by modifying the molecular structure. The fiber torsion test was reassessed and some preliminary cold draw experiments were reported. GRA

N90-26988# Washington State Univ., Pullman. Shock-Dynamics Lab.
NONLINEAR MATERIAL RESPONSE TO VERY RAPID ENERGY DEPOSITION Final Report, 1 Oct. 1986 - 31 Dec. 1989
Y. M. Gupta and P. F. Braunlich 23 Mar. 1990 38 p
(Grant AF-AFOSR-0081-87; AF Proj. 3484)
(AD-A221932; SDL-0142/0149-FTR; AFOSR-90-0638TR) Avail: NTIS HC A03/MF A01 CSCL 09/3

Results of a research effort to examine the nonlinear response of selected materials to rapid energy deposition are summarized. One part of the work focused on examining the response of brittle solids to plane shock waves. The other part of the work focused on understanding the mechanisms for laser energy deposition in transparent dielectrics. The shock wave effort has demonstrated the usefulness of making shear wave measurements for characterizing the shocked state. In fused silica, these measurements led to the finding of reversible, shear enhanced compaction and to a direct determination of stress deviators in the shocked state. The work on polycrystalline calcite represents the first study to use shear wave measurements to understand shock induced phase changes. Shear modulus decrease associated with the calcite transition was observed. The subsequent increase in shear modulus at higher compressions is surprising and, in conjunction with the longitudinal measurements, leads to the possibility that a phase other than calcite III is formed under shock loading. GRA

28 PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers; their storage and handling procedures; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion.*

N90-26989# Department of Energy, Washington, DC. Biofuels and Municipal Waste Technology Div.
HYDROGEN ENERGY COORDINATING COMMITTEE SUMMARY OF DOE HYDROGEN PROGRAMS FOR FY 1988 Annual Report
Jan. 1989 45 p
(DOE/CE-0242) Avail: NTIS HC A03/MF A01

A summary of various Department of Energy hydrogen energy research and development programs is presented, along with tables of DOE funding on hydrogen research. The Chemical/Hydrogen Energy Systems Program is investigating the separation of hydrogen from abundant resources such as water through the employment of non-fossil energy. Using fossil energy, the Surface Gasification Program is attempting to develop a hydrogen-rich synthesis gas from coal. The Fuel Cell Program is concerned with fuel processors which convert natural gas to fuel cell quality fuel. Other hydrogen-related projects are being conducted in the areas of fusion energy, inertial fusion, weapon applications and transportation systems. The DOE hydrogen research and technology summary forms are included as appendix A. B.G.

N90-26990# Southwest Research Inst., San Antonio, TX.
HAZARD CLASSIFICATION TESTING OF LIQUID PROPELLANTS Progress Report, 1 Oct. 1988 - 1 Oct. 1989
W. Herrera and G. Grelecki (Hazard Research Corp., Rockaway, NJ.) May 1990 29 p Sponsored by ARRADCOM, Picatinny Arsenal, NJ
(AD-A222070; ARAED-CR-90002) Avail: NTIS HC A03/MF A01 CSCL 21/9

The present TB 700-2 manual for establishing the hazard classification of energetic materials only addressed solid propellants and explosives in transportation and storage. The lack of a formal protocol for liquid propellants prompted the need for a program to provide the methodology, test procedures, test interpretations, and criteria for establishing a hazard classification. A methodology was submitted to the Safety Community for approval. The TB 700-2 manual tests were selected for evaluation as potential liquid propellant hazard classification candidates. Modifications had to be made to contain the liquid propellants for testing. This report addresses the small scale mandatory and non-mandatory interim classification tests, the modification required, the test results, and recommendation for establishing a hazard classification for a liquid propellant. GRA

N90-26991# National Fertilizer Development Center, Muscle Shoals, AL.
LABORATORY TESTS TO DETERMINE THE CHEMICAL AND PHYSICAL CHARACTERISTICS OF PROPELLANT-SOLVENT-FUEL OIL MIXTURES Final Report, Oct. 1989 - Feb. 1990
V. M. Norwood, D. J. Craft, and C. E. Breed Apr. 1990 189 p Sponsored by Army Toxic and Hazardous Materials Agency, Aberdeen Proving Ground, MD
(AD-A222270; CETHA-TE-CR-90043) Avail: NTIS HC A09/MF A01 CSCL 19/1

The military currently has an inventory of approximately 158,000 metric tons of propellants, explosives, and pyrotechnics, with a total of 249,000 metric tons projected by the year 1993. This inventory includes obsolete conventional munitions and waste propellant generated during the manufacturing process. The current alternatives to storage are open-air burning, open-air detonation, or incineration to slowly reduce the inventory of these materials. The United States Army Toxic and Hazardous Materials Agency (USATHAMA) is currently coordinating a program to assess the feasibility of utilizing propellants dissolved in an appropriate solvent and further blended with fuel oil as supplemental fuel for Army industrial combustors. The results from the initial phase of this program are discussed. GRA

N90-26992# EA Engineering Science and Technology, Inc., Lafayette, CA.
ENHANCED BIORECLAMATION OF JET FUELS: A FULL-SCALE TEST AT EGLIN AFB, FLORIDA Final Report, Nov. 1986 - Nov. 1988
R. E. Hinchee, D. C. Downey, J. K. Slaughter, D. A. Selby, M. S. Westray, and G. M. Long Sep. 1989 179 p
(Contract F08635-86-C-0341; AF Proj. 2103)
(AD-A222348; AFESC/ESL-TR-88-78) Avail: NTIS HC A09/MF A01 CSCL 21/4

The results are presented of a full scale field test of enhanced biodegradation conducted at a JP-4 jet fuel spill site on Eglin AFB FL. A complete description of site characterization methods, the enhanced biodegradation process and hardware, and the impact of this technology on soil and ground water contaminants is provided. The treatment limitations of this technology that were observed through intense monitoring of soil and ground water contaminant profiles are emphasized. Significant problems with hydrogen peroxide decomposition were documented in this test. This rapid decomposition resulted in poor oxygen distribution and biodegradation rates which were far less than laboratory microcosm studies had predicted. Several recommendations for improving field applications of enhanced biodegradation are provided, including a checklist for performing pilot tests of this technology. GRA

N90-26993# Ballistic Research Labs., Aberdeen Proving Ground, MD.
THE SENSITIVITY OF SEVERAL EXPLOSIVES TO IGNITION IN THE LAUNCH ENVIRONMENT Final Report, Jan. 1986 - Dec. 1988
John Starkenberg, Doenee L. McFadden, and Deborah L. Pilarski Apr. 1990 58 p
(AD-A221581; BRL-TR-3095) Avail: NTIS HC A04/MF A01 CSCL 19/1

Testing was completed on the sensitivity of Composition B (Comp B), TNT, Composition A3 (Comp A3) Type 2, LX-14, PBXW-113, PBX-0280 and PBX-0280/PE to ignition by the combined effects of air compression and deformation. Comp B exhibits one of the highest sensitivity levels and responds violently. The data for TNT provide no reason to believe that it is less sensitive to ignition than Comp B. Composition A3 Type 2 may be considered the least sensitive explosive tested. It exhibits a moderately high level of response violence. LX-14 exhibits a sensitivity intermediate between those of Comp B and Comp A-3 Type 2 and reacts very violently. PBXW-113 is by far the most sensitive in this test. It also produces the mildest response. The sensitivity of PBX-0280 is generally greater than that of Comp B. PBX-280/PE, on the other hand, appears quite insensitive. The results can be explained most satisfactorily in terms of each explosive's tendency to deconsolidate, or break up into small particles, during cavity collapse. GRA

N90-26994# Argonne National Lab., IL. Materials and Components Technology Div.
DEVELOPMENT OF A MATHEMATICAL MODEL FOR THE THERMAL DECOMPOSITION OF AVIATION FUELS Final Report, Sep. 1988 - Dec. 1989
John L. Krazinski and S. P. Vanka Dec. 1989 128 p
(Contract MIPR-FY1455-86-N0657; AF Proj. 2480)
(AD-A221673; WRDC-TR-89-2139) Avail: NTIS HC A07/MF A01 CSCL 21/4

This report describes the development of a mathematical model for predicting the rate of thermal decomposition of aviation fuels. The model provides a global description of the chemical and physical processes of fuel autoxidation, precursor formation, and deposition at a solid surface. The model contains several unknown parameters that must be determined for a particular fuel. Calibration of the model involves the determination of these parameters from experimental data. This report describes the calibration procedure and presents sample calculations from the calibrated model for both laminar and turbulent flows. Prior to development of the model, the existing literature was surveyed to assess available information on those physical and chemical processes relevant to the thermal decomposition problem. The report describes the results of a brief literature review covering the areas of fuel chemistry, transport processes, surface adhesion phenomena, and deposit-removal mechanisms. The report also discusses the existing data base for the thermal decomposition of aviation fuels. The data base consists primarily of results from heated-tube experiments, in which the rate of deposit formation is measured along the length of the tube. The deposition rates are typically correlated with the initial tube wall temperatures. GRA

29 MATERIALS PROCESSING

Includes space-based development of products and processes for commercial applications.

For biological materials see *55 Space Biology*.

N90-26995# Universitaet der Bundeswehr Muenchen, Neubiberg (Germany, F.R.). Inst. fuer Raumfahrttechnik.
APPROXIMATE NATURAL DAMPED FREQUENCIES OF A FINITE VISCOUS FLOATING-ZONE UNDER ZERO-GRAVITY CONDITION
Helmut Franz Bauer 1988 27 p
(LRT-WE-9-FB-8(1988); ETN-90-97331) Avail: NTIS HC A03/MF A01

The damped natural frequencies of a finite viscous cylindrical liquid bridge was determined. Various mixed adherence and slip conditions at the top and bottom wall are considered. The results show that viscosity reduces the oscillation frequencies, while the increase of the surface tension or decrease of viscosity approaches the results of frictionless liquid. The free surface displacement was determined. ESA

N90-26996# Universitaet der Bundeswehr Muenchen, Neubiberg (Germany, F.R.). Inst. fuer Raumfahrttechnik.
RESPONSE OF A LIQUID COLUMN TO ONE-SIDED AXIAL EXCITATION IN ZERO-GRAVITY
Helmut Franz Bauer 1989 122 p
(LRT-WE-9-FB-3(1989); ETN-90-97335) Avail: NTIS HC A06/MF A01

A finite cylindrical liquid column of incompressible and frictionless liquid is subjected at the upper end to axial harmonic excitation. The liquid system is in a zero-gravity environment. It is held together by surface tension. The response of the system was determined for the free surface elevation and the velocity distribution. The transient behavior was investigated. Damping was introduced in the resonance terms. The first resonance response is found to be sharply tuned and could be missed by a sweeping experiment. The investigation was performed for the preparation of the German D2 Spacelab mission. ESA

N90-26997# Universitaet der Bundeswehr Muenchen, Neubiberg (Germany, F.R.). Inst. fuer Raumfahrttechnik.
NON-LINEAR AXIAL VIBRATIONS OF A CYLINDRICAL LIQUID COLUMN IN ZERO-GRAVITY
Helmut Franz Bauer and Werner Eidel 1989 29 p
(LRT-WE-9-FB-4(1989); ETN-90-97336) Avail: NTIS HC A03/MF A01

The nonlinear response of an axially excited cylindrical liquid column is studied. It consists of frictionless liquid. The harmonic excitation is investigated. Free nonlinear surface displacement-response were determined and the softening of the liquid behavior is shown. The results are to be used for planning of the liquid column resonances experiments in the second German Spacelab mission D2. ESA

N90-26998# Universitaet der Bundeswehr Muenchen, Neubiberg (Germany, F.R.). Inst. fuer Raumfahrttechnik.
RESPONSE OF A LIQUID COLUMN TO COUNTER-DIRECTIONAL EXCITATION UNDER ZERO-GRAVITY
Helmut Franz Bauer 1989 45 p
(LRT-WE-9-FB-6(1989); ETN-90-97337) Avail: NTIS HC A03/MF A01

A finite cylindrical column of incompressible and frictionless liquid is subjected to a counter-directional axial harmonic excitation. The liquid system is in a zero-gravity environment. It is held together by surface tension. The response of the system was determined for the free surface elevation and the velocity distribution. The transient behavior was treated. Damping was introduced in the resonance terms. The first appearing resonance response is found to be sharply tuned and could be missed by a sweeping experiment. The investigation was performed for the preparation of the German D2 Spacelab mission. ESA

N90-26999# Universitaet der Bundeswehr Muenchen, Neubiberg (Germany, F.R.). Inst. fuer Raumfahrttechnik.
RESPONSE OF A LIQUID COLUMN TO UNEQUAL COUNTER-DIRECTIONAL EXCITATION UNDER ZERO-GRAVITY
Helmut Franz Bauer 1989 49 p
(LRT-WE-9-FB-7(1989); ETN-90-97338) Avail: NTIS HC A03/MF A01

The response of an axially excited cylindrical liquid column of nonviscous liquid was investigated for different harmonic excitation of its top and bottom. Free surface displacement and velocity response were determined. Damped response was obtained by introducing a damping factor in the resonance term. The results are to be used for the planning of the experiments in the second German Spacelab mission D2. They show that the first resonance is sharply tuned and that higher modes may have a larger response amplitude than the fundamental mode. ESA

N90-27000# Universitaet der Bundeswehr Muenchen, Neubiberg (Germany, F.R.). Inst. fuer Raumfahrttechnik.
RESPONSE OF A VISCOUS LIQUID COLUMN TO PITCHING- AND ROLL-EXCITATION IN ZERO-GRAVITY ENVIRONMENT
Helmut Franz Bauer 1989 55 p
(LRT-WE-9-FB-10(1989); ETN-90-97341) Avail: NTIS HC A04/MF A01

The response of a viscous liquid column to pitching and roll excitation was determined. The no-slip condition at the top and the bottom of the liquid column was abandoned in the pitching case. The response of the free liquid surface displacement and the velocity distribution was determined as a function of the reduced frequency for various surface tension parameters. The resonance amplitudes are finite and disappear for higher modes and shorter liquid bridges. The velocity distribution, effective moment of inertia and effective damping was obtained for the liquid in roll excitation. ESA

N90-27001# Universitaet der Bundeswehr Muenchen, Neubiberg (Germany, F.R.). Inst. fuer Raumfahrttechnik.
RESPONSE OF DIFFERENTLY AXIALLY EXCITED VISCOUS LIQUID BRIDGES IN ZERO-GRAVITY
Helmut Franz Bauer 1989 37 p
(LRT-WE-9-FB-14(1989); ETN-90-97345) Avail: NTIS HC A04/MF A01

A cylindrical liquid column of incompressible and viscous liquid is subjected to different axial excitation: one-sided, counter-directional and double-sided unequal excitations. The response of the free liquid surface relating to the velocity and pressure distributions were determined. ESA

31 ENGINEERING (GENERAL)

Includes vacuum technology; control engineering; display engineering; cryogenics; and fire prevention.

N90-27002# Rolls-Royce Ltd., Derby (England).
COST EFFECTIVE TECHNOLOGY
S. C. Miller 4 Sep. 1989 24 p Presented at 9th ISABE, Athens, Greece, 4-9 Sep. 1989 Previously announced in IAA as A90-17447
(PNR90664; ETN-90-97150) Copyright Avail: NTIS HC A03/MF A01

With relation to advanced technology for gas turbines, the overall process of product definition and development, concentrating particularly on the integration of activities between engineering design and manufacturing, is surveyed. The development of new philosophies in each of these spheres of activity is concluded to be cost effective technology and to make a highly significant contribution to the competitiveness and profitability of the industry. ESA

N90-27003# Stanford Univ., CA. Dept. of Aeronautics and Astronautics.
ULTRA PRECISION MACHINING Final Report, 1982-1990
Daniel B. DeBra, Lambertus Hesselink, and Thomas Binford 20 May 1990 139 p
(Contract N00014-89-J-1608)
(AD-A222422) Avail: NTIS HC A07/MF A01 CSCL 13/8

There are a number of fields that require or can use to advantage very high precision in machining. For example, further development of high energy lasers and x ray astronomy depend critically on the manufacture of light weight reflecting metal optical components. To fabricate these optical components with machine tools they will be made of metal with mirror quality surface finish. By mirror quality surface finish, it is meant that the dimensions tolerances on the order of 0.02 microns and surface roughness

of 0.07. These accuracy targets fall in the category of ultra precision machining. They cannot be achieved by a simple extension of conventional machining processes and techniques. They require single crystal diamond tools, special attention to vibration isolation, special isolation of machine metrology, and on line correction of imperfection in the motion of the machine carriages on their way.
GRA

32 COMMUNICATIONS AND RADAR

Includes radar; land and global communications; communications theory; and optical communications.

For related information see also *04 Aircraft Communications and Navigation* and *17 Space Communications, Spacecraft Communications, Command and Tracking.* For search and rescue see *03 Air Transportation and Safety,* and *16 Space Transportation.*

N90-27004*# Houston Univ., Clear Lake, TX. Research Inst. for Computing and Information Systems.
COMMUNICATIONS AND TRACKING EXPERT SYSTEMS STUDY Interim Report, period ending 31 Dec. 1986
T. F. Leibfried, Terry Feagin, and David Overland 30 Jan. 1987 45 p
(Contract NCC9-16)
(NASA-CR-185935; NAS 1.26:185935) Avail: NTIS HC A03/MF A01 CSCL 17B

The original objectives of the study consisted of five broad areas of investigation: criteria and issues for explanation of communication and tracking system anomaly detection, isolation, and recovery; data storage simplification issues for fault detection expert systems; data selection procedures for decision tree pruning and optimization to enhance the abstraction of pertinent information for clear explanation; criteria for establishing levels of explanation suited to needs; and analysis of expert system interaction and modularization. Progress was made in all areas, but to a lesser extent in the criteria for establishing levels of explanation suited to needs. Among the types of expert systems studied were those related to anomaly or fault detection, isolation, and recovery.
Author

N90-27005# Office of Technology Assessment, Washington, DC.
CRITICAL CONNECTIONS: COMMUNICATION FOR THE FUTURE
Jan. 1990 394 p
(PB90-182742; OTA-CIT-407; LC-89-600713) Avail: NTIS HC A17/MF A03; SOD HC $17.00 as 052-003-01143-3 CSCL 17B

A broad context for evaluating the impacts of new communication technologies is provided. The implications of new communication technologies for business, politics, culture, and individuals, and possible strategies and options for congressional consideration are suggested.
Author

N90-27006# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France). Avionics Panel.
SPEECH ANALYSIS AND SYNTHESIS AND MAN-MACHINE SPEECH COMMUNICATIONS FOR AIR OPERATIONS
May 1990 128 p Lecture series held in Trondheim, Norway, 14-15 May 1990, in Ankara, Turkey, 17-18 May 1990, and in Asbury Park, NJ, 22-23 May 1990
(AGARD-LS-170; ISBN-92-835-0561-1) Copyright Avail: NTIS HC A07/MF A01; Non-NATO Nationals requests available only from AGARD/Scientific Publications Executive

Following an explanation and discussion of the importance of voice communications for military operations, including the environmental and propagation effects and ECM, the Lectures will outline: speech coding which is mainly concerned with man-to-man voice communication; speech synthesis which deals with machine-to-man communication; and speech recognition which is related to man-to-machine communication. All these are techniques which involve speech compression or speech coding at low-bit rates are needed for transmitting speech messages with a high level of security and reliability over low data-rate channels and for other applications such as memory-efficient systems for voice storage and response. For individual titles, see N90-27007 through N90-27014.

N90-27007# Technical Univ. of Istanbul (Turkey).
OVERVIEW OF REQUIREMENTS AND NETWORKS FOR VOICE COMMUNICATIONS AND SPEECH PROCESSING
A. Nejat Ince *In* AGARD, Speech Analysis and Synthesis and Man-Machine Speech Communications for Air Operations May 1990 27 p (For primary document see N90-27006 21-32)
Copyright Avail: NTIS HC A07/MF A01; Non-NATO Nationals requests available only from AGARD/Scientific Publications Executive

The use of voice for military and civil communications are discussed. The military operational requirements are outlined in relation to air operations, including the effects of propagational factors and electronic warfare. Structures of the existing NATO communications network and the evolving Integrated Service Digital Network (ISDN) are reviewed to show how they meet the requirements. It is concluded that speech coding at low-bit rates is a growing need for transmitting speech messages with a high level of security and reliability over low data-rate channels and for memory-efficient systems for voice storage, voice response, and voice mail. Furthermore, it is pointed out that the low-bit rate voice coding can ease the transition to shared channels for voice and data and can readily adopt voice messages for packet switching. The speech processing techniques and systems are then outlined as an introduction to the lectures of this series in terms of: the character of the speech signal, its generation and perception; speech coding which is mainly concerned with man-to-man voice communication; speech synthesis which deals with machine-to-man communication; speech recognition which is related to man-to-machine communication; and quality assessment of speech system and standards.
Author

N90-27008# Marconi Speech and Information Systems, Portsmouth (England).
THE SPEECH SIGNAL
Melvyn J. Hynt *In* AGARD, Speech Analysis and Synthesis and Man-Machine Speech Communications for Air Operations May 1990 12 p (For primary document see N90-27006 21-32)
Copyright Avail: NTIS HC A07/MF A01; Non-NATO Nationals requests available only from AGARD/Scientific Publications Executive

A non-mathematical introduction is provided to the speech signal. The production of speech is first described, including a survey of the categories into which speech sounds are grouped. This is followed by an account of some properties of human perception of sounds in general and of speech in particular. Speech is then compared with other signals. It is argued that it is more complex than artificial message bearing signals, and that unlike such signals speech contains no easily identified context-independent units that can be used in bottom-up decoding. Words and phonemes are examined, and phonemes are shown to have no simple manifestation in the acoustic signal. Speech communication is presented as an interactive process, in which the listner actively reconstructs the message from a combination of acoustic cues and prior knowledge, and the speaker takes the listner's capacities into account in deciding how much acoustic information to provide. The final section compares speech and text, arguing that cultural emphasis on written communication causes projection of the properties of text onto speech and that there are large differences between the styles of language appropriate for the two modes of communication. These differences are often ignored, with unfortunate results.
Author

N90-27009# California Univ., Santa Barbara. Center for Information Processing Research.
SPEECH CODING
Allen Gersho *In* AGARD, Speech Analysis and Synthesis and

Man-Machine Speech Communications for Air Operations May 1990 14 p Sponsored in part by Bell Communications Research, Inc., Bell-Northern Research, Inc., Rockwell International Corp., and the California State MICRO Program (For primary document see N90-27006 21-32)
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Recent advances in algorithms and techniques for speech coding now permit high quality voice reproduction at remarkably low bit rates. The advent of powerful single-ship signal processors has made it cost effective to implement these new and sophisticated speech coding algorithms for many important applications in voice communication and storage. Some of the main ideas underlying the algorithms of major interest today are reviewed. The concept of removing redundancy by linear prediction is reviewed, first in the context of predictive quantization or DPCM. Then linear predictive coding, adaptive predictive coding, and vector quantization are discussed. The concepts of excitation coding via analysis-by-synthesis, vector sum excitation codebooks, and adaptive postfiltering are explained. The main idea of vector excitation coding (VXC) or code excited linear prediction (CELP) are presented. Finally low-delay VXC coding and phonetic segmentation for VXC are described. Author

N90-27010# Bell Telephone Labs., Inc., Murray Hill, NJ. Speech Research Dept.
CURRENT METHODS OF DIGITAL SPEECH PROCESSING
Lawrence R. Rabiner, B. S. Atal, and J. L. Flanagan *In* AGARD, Speech Analysis and Synthesis and Man-Machine Speech Communications for Air Operations 9 p(SEE N90-27006 21-32) May 1990 Submitted for publication (For primary document see N90-27006 21-32)
Copyright Avail: NTIS HC A07/MF A01; Non-NATO Nationals requests available only from AGARD/Scientific Publications Executive

The field of digital speech processing includes the areas of speech coding, speech synthesis, and speech recognition. With the advent of faster computation and high speed VLSI circuits, speech processing algorithms are becoming more sophisticated, more robust, and more reliable. As a result, significant advances have been made in coding, synthesis, and recognition, but, in each area, there still remain great challenges in harnessing speech technology to human needs. In the area of speech coding, current algorithms perform well at bit rates down to 16 kbits/sec. Current research is directed at further reducing the coding rate for high-quality speech into the data speed range, even as low as 2.4 kbits/sec. In text-to-speech synthesis speech is produced which is very intelligible but is not yet completely natural. Current research aims at providing higher quality and intelligibility to the synthesis speech produced by these systems. Finally, in the area of speech and speaker recognition, present systems provide excellent performance on limited tasks; i.e., limited vocabulary, modest syntax, small talker populations, constrained inputs, and favorable signal-to-noise ratios. Current research is directed at solving the problem of continuous speech recognition for large vocabularies, and at verifying talker's identities from a limited amount of spoken text. Author

N90-27011# Bell Telephone Labs., Inc., Murray Hill, NJ. Speech Research Dept.
SPEECH RECOGNITION BASED ON PATTERN RECOGNITION TECHNIQUES
Lawrence R. Rabiner *In* AGARD, Speech Analysis and Synthesis and Man-Machine Speech Communications for Air Operations May 1990 10 p (For primary document see N90-27006 21-32)
Copyright Avail: NTIS HC A07/MF A01; Non-NATO Nationals requests available only from AGARD/Scientific Publications Executive

Algorithms for speech recognition can be characterized broadly as pattern recognition approaches and acoustic phonetic approaches. To date, the greatest degree of success in speech recognition has been obtained using pattern recognition paradigms. The use of pattern recognition techniques were applied to the problems of isolated word (or discrete utterance) recognition, connected word recognition, and continuous speech recognition. It is shown that understanding (and consequently the resulting recognizer performance) is best to the simplest recognition tasks and is considerably less well developed for large scale recognition systems. Author

N90-27012# Institute for Perception RVO-TNO, Soesterberg (Netherlands).
QUALITY EVALUATION OF SPEECH PROCESSING SYSTEMS
Herman J. M. Steeneken *In* AGARD, Speech Analysis and Synthesis and Man-Machine Speech Communications for Air Operations May 1990 10 p (For primary document see N90-27006 21-32)
Copyright Avail: NTIS HC A07/MF A01; Non-NATO Nationals requests available only from AGARD/Scientific Publications Executive

An overview of assessment methods is given for speech communication systems, speech synthesis systems, and speech recognition systems. The first two systems require an evaluation in terms of intelligibility measures. Several subjective and objective measures will be discussed. Evaluation of speech recognizers requires a different approach as the recognition rate normally depends on recognizer-specific parameters and external factors. Some results of the assessment methods for recognition systems will be discussed. Case studies are given for each group of systems. Author

N90-27013# Technical Univ. of Istanbul (Turkey).
SPEECH PROCESSING STANDARDS
A. Nejat Ince *In* AGARD, Speech Analysis and Synthesis and Man-Machine Speech Communications for Air Operations May 1990 14 p (For primary document see N90-27006 21-32)
Copyright Avail: NTIS HC A07/MF A01; Non-NATO Nationals requests available only from AGARD/Scientific Publications Executive

Speech processing standards are given for 64, 32, 16 kb/s and lower rate speech and more generally, speech-band signals which are or will be promulgated by CCITT and NATO. The International Telegraph and Telephone Consultative Committee (CCITT) of the International body which deals, among other things, with speech processing within the context of ISDN. Within NATO there are also bodies promulgating standards which make interoperability, possible without complex and expensive interfaces. Some of the applications for low-bit rate voice and the related work undertaken by CCITT Study Groups which are responsible for developing standards in terms of encoding algorithms, codec design objectives as well as standards on the assessment of speech quality, are highlighted. Author

N90-27014# Rome Air Development Center, Griffiss AFB, NY.
APPLICATION OF AUDIO/SPEECH RECOGNITION FOR MILITARY APPLICATIONS
Edward J. Cupples and Bruno Beek *In* AGARD, Speech Analysis and Synthesis and Man-Machine Speech Communications for Air Operations May 1990 10 p (For primary document see N90-27006 21-32)
Copyright Avail: NTIS HC A07/MF A01; Non-NATO Nationals requests available only from AGARD/Scientific Publications Executive

Increases in the functional capabilities of military systems have made these systems increasingly more difficult to operate. Increased operator workload in modern workstations and aircraft have produced operator stress and fatigue, resulting in degraded operator performance, especially in time critical tasks. One reason for this problem is that both data entry and system control functions are often controlled via the systems keyboard. In some systems functions are nested many layers deep making the system inefficient and difficult to use. For this reason RADC has been developing technology to improve the interface between the Air Force system and its operator. Many efforts and several

technologies are being pursued in speech recognition and synthesis, multimodal interface techniques, and voice interactive concepts and methods. This work is being conducted to satisfy the Air Force requirements for modern communication stations and the FORECAST 2 Battle Management and Super Cockpit Programs. Author

N90-27015*# National Aeronautics and Space Administration. Pasadena Office, CA.
PLANAR MICROSTRIP YAGI ARRAY ANTENNA Patent Application
John Huang, inventor (to NASA) (Jet Propulsion Lab., California Inst. of Tech., Pasadena.) 30 Mar. 1990 13 p
(Contract NAS7-918)
(NASA-Case-NPO-17873-1-CU; NAS 1.71:NPO-17873-1-CU; US-Patent-Appl-SN-501892) Avail: NTIS HC A03/MF A01 CSCL 20N

A planar microstrip antenna constructed in accordance with the principles of a Yagi antenna provides a single driven patch surrounded by an isolated reflector and one or more coplanar directors to provided endfire beam directivity without requiring power dividers or phase shifters. NASA

N90-27016*# National Aeronautics and Space Administration. Pasadena Office, CA.
MULTISTAGE ESTIMATION OF RECEIVED CARRIER SIGNAL PARAMETERS UNDER VERY HIGH DYNAMIC CONDITIONS OF THE RECEIVER Patent Application
Rajendra Kumar, inventor (to NASA) (Jet Propulsion Lab., California Inst. of Tech., Pasadena.) 14 May 1990 47 p
(Contract NAS7-918)
(NASA-Case-NPO-17911-1-CU; NAS 1.71:NPO-17911-1-CU; US-Patent-Appl-SN-517114) Avail: NTIS HC A03/MF A01 CSCL 17B

A multistage estimator is provided for the parameters of a received carrier signal possibly phase-modulated by unknown data and experiencing very high Doppler, Doppler rate, etc., as may arise, for example, in the case of Global Positioning Systems (GPS) where the signal parameters are directly related to the position, velocity and jerk of the GPS ground-based receiver. In a two-stage embodiment of the more general multistage scheme, the first stage, selected to be a modified least squares algorithm referred to as differential least squares (DLS), operates as a coarse estimator resulting in higher rms estimation errors but with a relatively small probability of the frequency estimation error exceeding one-half of the sampling frequency, provides relatively coarse estimates of the frequency and its derivatives. The second stage of the estimator, an extended Kalman filter (EKF), operates on the error signal available from the first stage refining the overall estimates of the phase along with a more refined estimate of frequency as well and in the process also reduces the number of cycle slips. NASA

N90-27017# Sandia National Labs., Albuquerque, NM.
PC-BASED CLOSED-CIRCUIT TELEVISION SYSTEM
Daniel Christoffersen and Carl Clark 1990 8 p Presented at the Institute of Nuclear Materials Management Conference, Los Angeles, CA, 15-18 Jul. 1990
(Contract DE-AC04-76DP-00789)
(DE90-013366; SAND-90-0047C; CONF-9007106-26) Avail: NTIS HC A02/MF A01

The PC-based closed-circuit television (CCTV) system is a low-cost, highly functional alternative to conventional video system equipment. The system provides routing switching, character generation, video presence detection, and solid-state video recording and replay by using four uniquely designed boards that fit into the backplane slots of an IBM PC-XT-compatible personal computer. Each board controls 16 separate channels, and the boards can be daisy-chained together to build larger, more powerful systems. The system can be configured to handle as many as 240 input signals or up to 48 output channels, and uses a redundant video bus loop. The video bus can be tapped into throughout the loop to provide localized routing switching within several buildings, and video termination at multiple locations, such as security operators' stations. This approach reduces cabling costs and allows additional routing switchers to be added easily with little impact on existing equipment. The system is capable of communicating with several control interfaces, and control software is currently in place for communicating via an RS-232 link and the Intel BitBus network. The hardware drivers are Microsoft C modules that can be linked with a user developed control program. DOE

N90-27018# Massachusetts Inst. of Tech., Cambridge. Lab. for Computer Science.
THE NEED FOR HEADERS: AN IMPOSSIBILITY RESULT FOR COMMUNICATION OVER UNRELIABLE CHANNELS
Alan Fekete (Sydney Univ., Australia) and Nancy A. Lynch Mar. 1990 27 p
(Contracts N00014-83-K-0125; N00014-89-J-1988)
(AD-A222823; MIT/LCS/TM-428) Avail: NTIS HC A03/MF A01 CSCL 12/5

It is proved that any protocol that constructs a reliable data link service using a physical channel service necessarily includes in the packets some header information that enables the protocol to treat different packets differently. The physical channel considered is permitted to lose, but not reorder or duplicate packets. The formal framework used for the proof is the input/output automation moded. GRA

N90-27019# Illinois Univ., Urbana-Champaign. Coordinated Science Lab.
SPREAD-SPECTRUM COMMUNICATIONS IN NON-GAUSSIAN CHANNELS Final Report, 15 Jun. 1986 - 30 Sep. 1989
H. Vincent Poor 27 May 1990 7 p
(Contract DAAL03-86-K-0093)
(AD-A222886; ARO-23026.7-EL) Avail: NTIS HC A02/MF A01 CSCL 25/5

The overall purpose project was to seek new methods for improving the robustness and efficiency of spread spectrum communications systems operating over non-Gaussian channels. The study was motivated in large part by the fact that modern military radio networks must operate in complex and variable noise environments that are often dominated by impulsive, non-Gaussian man-made noise sources. The research progressed in three basic areas: (1) optimum multiuser demodulation techniques; (2) direct sequence spread spectrum multiple-access (DS/SSMA) signaling through impulsive channels; and (3) improved suppression of narrowband interferers from spread spectrum signals. The common thread binding these three disparate multiuser communications research topics is the fact that each involves the processing of signals in non-Gaussian interference. In the first case, the non-Gaussian interference is the multiuser noise interfering with the demodulation of a given user; in the second case, the non-Gaussian interference is the impulsive noise dominating the channel; and in the third case, the non-Gaussian interference is the spread spectrum signal itself as it interferes with the prediction and consequent excision of the narrowband interferer. GRA

N90-27020# Louisiana State Univ., Baton Rouge.
NONLINEAR REAL-TIME SIGNAL PROCESSING Final Report, 1 Feb. 1987 - 31 Jan. 1990
William A. Porter 1 Jun. 1990 5 p
(Contract DAAL03-87-K-0026)
(AD-A222889; ARO-24962.13-MA) Avail: NTIS HC A01/MF A01 CSCL 12/1

The grant supported in part a research effort in Nonlinear Real Time Signal Processing. The effort was composed of three interacting lines of development: advances in array processing, advances in fast algorithmic forms, applications of the above to polynomic and m-D signal processing algorithms. GRA

N90-27021# Air Force Systems Command, Wright-Patterson AFB, OH. Foreign Technology Div.
THE APPLICATION OF SAW DEVICES IN EXPANDED FREQUENCY SPECTRUM COMMUNICATIONS
Suochun Feng, Chenghao Wang, Guohua Jin, and Liyan Li 25

Apr. 1990 13 p Transl. into ENGLISH from Yingyong Shenyxue (China), no. 2, 1988 p 1-5 Original document prepared by Academy of Sciences
(Contract F33657-88-D-2188)
(AD-A222958; FTD-ID(RS)T-0146-90) Avail: NTIS HC A03/MF A01 CSCL 25/5

Expanded frequency spectrum communications, hereafter referred to as expanded communications is a very important technology in modern communications. It features good resistance to interference and good security capabilities. In the area of rangefinding, it is able to improve the rangefinding accuracy because rangefinding accuracy is related to the expanded band. In use, it offers code portion multiple addresses; multiple users can use a channel jointly. SAW devices have many applications in a communications system. This paper is intended chiefly to describe the application of the SAW-MSK signal modulator/generator and the SAW convoluter in an expended communications system, and to report on several actual results. In today's world, there are many forms of expanded communication. MSK (minimum frequency drift key control) signals are one kind of binary digit modulating signal whose excellent functions have attracted attention. This is because, in comparison with the frequency used PSK signals, they not only possess the features of a constant amplitude and continuous phase, but they also have a relatively concentrated energy spectrum. Radiated power outside the band rolls down quickly, and the crossover interference between the frequency channels is small. GRA

N90-27022# Georgia Inst. of Tech., Atlanta. School of Electrical Engineering.
TWO-DIMENSIONAL SIGNAL PROCESSING AND STORAGE, AND THEORY AND APPLICATIONS OF ELECTROMAGNETIC MEASUREMENTS Annual Report, 1 Jan. - 31 Dec. 1989
R. W. Schafer and D. T. Paris 1 Jan. 1990 114 p
(Contract DAAL03-87-K-0059)
(AD-A222984) Avail: NTIS HC A06/MF A01 CSCL 09/1

This is an annual report on research conducted under the auspices of the Joint Services Electronics Program. Specific topics covered are: digital signal processing, parallel processing architectures, two-dimensional optical storage and processing, hybrid optical/digital signal processing, electromagnetic measurements in the time domain, and automatic radiation measurements for near-field and far field transformations. GRA

N90-27023# Lee (J. S.) Associates, Inc., Arlington, VA.
STUDIES OF ECCM IMPROVEMENTS FOR FREQUENCY-HOPPING CPFSK SYSTEMS Final Report
J. S. Lee, L. E. Miller, and R. H. French 30 May 1990 130 p
(Contract DAAL03-89-C-0010)
(AD-A222995; JC-2053-A; ARO-26301.1-EL-S) Avail: NTIS HC A07/MF A01 CSCL 17/4

The performance of frequency hopping CPFSK modulations (such as used in several Army radio systems) in the presence of worst case partial band noise jamming (WCPBNJ) is derived for both limiter-discriminator and differential detector forms of receiver. The transmitter is assumed to repeat the data L times on different hops, and the receiver combines the L chips for each data symbol in a way to mitigate the effects of the jamming. Hard-decision combining simply makes a binary decision on each chip, then a majority decision on the whole symbol; this limits a jammed chip to one vote. AGC combining weights each analog chip sample in inverse proportion to the received noise power and decides on the basis of the sum of weighted chip samples; jammed chips tend to be weighted less. Analysis and computations show that either form of ECM combining can produce a 27 dB gain against WCPBNJ, and with error-control coding, a 31 to 33 dB gain. Coding alone can give a 28 to 29 dB gain. Soft decoding of hard-decision diversity combining gives 1.4 dB more gain than hard decoding. It is also shown that, due to the spectral attenuation characteristics of the receiver's IF filter, the effects of the transient phase difference between the incoming hopping waveform and the receiver's synthesizer are primarily confined to an interval of duration T + ts + tau, where T is the symbol duration (inverse of IF bandwidth), ts is the synthesizer switching time, and tau is the offset in synchronization between the received signal and the receiver's synthesizer. GRA

N90-27024# Rome Air Development Center, Griffiss AFB, NY.
BACKSCATTER ENHANCEMENT IN SCATTERING FROM ROUGH SURFACES Report, Jul. 1988 - Jan. 1989
Robert J. Papa and Margaret B. Woodworth Jun. 1989 43 p
(AD-A223110; RADC-TR-89-88) Avail: NTIS HC A03/MF A01 CSCL 17/9

Stealth technology has advanced to the point where radar target cross sections are so small there is a great need to determine mean clutter cross sections and clutter variability with great accuracy. Established clutter prediction techniques result in forward scatter values that exceed backscatter. There is some new experimental data on light scattering from rough metallic surfaces which shows there is an enhancement of backscattering in the antispecular direction under some conditions. This unusual result has been addressed by several theoretical analyses with varying success at confirmation. In this report an integral form of a physical optics representation is used to simulate the experimental conditions. For a one-dimensional surface height variation this model predicts enhanced backscatter at optical frequencies. Additional calculations for the more significant radar case of microwave frequencies and a dielectric surface again predict an increase in backscatter for large or intermediate surface slope conditions. GRA

N90-27025# Arcon Corp., Waltham, MA.
RADC/EEV DIAGNOSTIC RHYME TEST SYSTEM IMPROVEMENTS Interim Report, Feb. 1986 - Jun. 1988
J. D. Tardelli, J. LeBlanc, and P. D. Gatewood Nov. 1989 89 p
(Contract F19628-85-C-0057; AF Proj. 7820)
(AD-A223187; TR-88-01; RADC-TR-89-256) Avail: NTIS HC A05/MF A01 CSCL 25/4

This report fully documents the current Diagnostic Rhyme Test (DRT) System used at RADC/EEV for the test and evaluation of the intelligibility of digital voice communication systems. All improvements to this system are presented in detail. This report is structured to serve both as a guide for the use of the DRT system and as a reference for modification of the software or for conversion of the software to another facility. This report documents four special projects that are associated with the DRT system. A modification to the DRT that allows for the measurement of the intelligibility of systems that are heavily affected by transmission drop-outs or bursts of transmission errors is presented. A method and system for performing the DRT at Field sites is given. This method includes software for the presentation of test words to the speaker and the collection of listener response data. The ability to repeat partial sections of a test is provided. The procedures used for the generation of the DOD Digital Voice Processing Consortium DRT/DAM Digital Master Library are given. This master library of source material for DRT/DAM testing of voice communication systems is discussed. Contents of the library are provided. GRA

N90-27026# Army Materials Technology Lab., Watertown, MA. Ceramics Research Branch.
A SUMMARY OF MEASUREMENTS OF PERMITTIVITIES AND PERMEABILITIES OF SOME MICROWAVE ABSORBING MATERIALS Final Report
W. A. Spurgeon, M. ElRayess, P. Dorsey, and C. Vittoria (Northeastern Univ., Boston, MA.) May 1990 68 p Sponsored by Army Lab. Command, Adelphi, MD
(AD-A223221; MTL-TR-90-26) Avail: NTIS HC A04/MF A01 CSCL 20/14

This report presents results of measurements of permittivities and permeabilities of assorted materials collected by the U.S. Army Office of Low Observables Technology and Applications (LOTA), and by the U.S. Army Materials Technology Laboratory (MTL). The samples fell into the following categories: (1) Pure materials (Teflon, plexiglasses and casting plastic); (2) Metal-coated

microspheres; (3) Carbospheres, both uncoated and metal coated; (4) Ferrites; (5) Magnetic metal flake; (6) Ceramic matrix composites; and (7) A standard paint. The data and its limitations and plans for additional testing are presented in the text. The most interesting results were obtained for a Rockwell Ferrite and for a 50/50 ferronickel flake which showed magnetic loss from 2 to 18 GHz. GRA

N90-27027# University of Southern California, Los Angeles. Communication Sciences Inst.
ADVANCED COMMUNICATION PROCESSING TECHNIQUES Final Report, 13 Feb. 1989 - 30 Jun. 1990
Robert A. Scholtz 1990 482 p Workshop held in Ruidoso, NM, 14-17 May 1989
(Contract DAAL03-89-G-0016)
(AD-A223244; CSI-90-04-01; ARO-26634.1-EL-CF) Avail: NTIS HC A21/MF A03 CSCL 25/5

This document contains the proceedings of the workshop Advanced Communication Processing Techniques, held May 14 to 17, 1989, near Ruidoso, New Mexico. Sponsored by the Army Research Office (under Contract DAAL03-89-G-0016) and organized by the Communication Sciences Institute of the University of Southern California, the workshop had as its objective to determine those applications of intelligent/adaptive communication signal processing that have been realized and to define areas of future research. We at the Communication Sciences Institute believe that there are two emerging areas which deserve considerably more study in the near future: (1) Modulation characterization, i.e., the automation of modulation format recognition so that a receiver can reliably demodulate a signal without using a priori information concerning the signal's structure, and (2) the incorporation of adaptive coding into communication links and networks. (Encoders and decoders which can operate with a wide variety of codes exist, but the way to utilize and control them in links and networks is an issue). To support these two new interest areas, one must have both a knowledge of (3) the kinds of channels and environments in which the systems must operate, and of (4) the latest adaptive equalization techniques which might be employed in these efforts. GRA

N90-27028# Naval Postgraduate School, Monterey, CA. Dept. of Oceanography.
DEPENDENCE OF RADAR BACKSCATTER ON THE ENERGETICS OF THE AIR-SEA INTERFACE Ph.D. Thesis
Marie C. Colton Dec. 1989 237 p
(AD-A221966) Avail: NTIS HC A11/MF A02 CSCL 17/9

The Normalized Radar Cross-Section (NRCS), the fundamental measurement made by radar scatterometers, was obtained as part of the Water-Air Vertical Exchanges 1987 (WAVES87) experiment. The experiment was designed to evaluate the effects of environmental parameters on the NRCS and was performed from a research tower located in Lake Ontario, on which two microwave scatterometers operating at 14.0 and 5.0 GHz were installed for six weeks in the autumn of 1987. The novel aspect of this experiment was that the 14.0 GHz radar automatically rotated through 300 deg in azimuth angle at six different incidence angles to the water surface, accompanied by simultaneous measurements of wind stress and high resolution directional wave spectra. Therefore, the incidence and azimuthal angle behavior of the NRCS was examined as a function of wind speed, friction velocity, wind direction, wave direction and atmospheric stability. The dependence of the NRCS on wind speed for various incidence angles is similar to previous results. However, the slope exponents of the NRCS vs. 19.5m wind speed curves at intermediate incidence angles are higher than the corresponding open ocean measurements. Scaling the lake neutral wind speed data by the ratio of lake to ocean drag coefficients reduces the slopes of the curves and suggests the drag coefficient has a sea state dependence. GRA

N90-27029# Naval Air Development Center, Warminster, PA. Dept. of Communication and Navigation Technology.
COMMUNICATIONS NETWORK ANALYSIS TOOL Final Report
Wayne Phillips and Gary Dunn 1 Nov. 1989 30 p Sponsored by Naval Air Systems Command, Washington, DC
(AD-A222061; NADC-89099-40) Avail: NTIS HC A03/MF A01 CSCL 25/5

The Communications Network Analysis Tool (CNAT) is a set of computer programs that aids in the performance evaluation of a communication system in a real-world scenario. Communication network protocols can be modeled and battle group connectivity can be analyzed in the presence of jamming and the benefit of relay platforms can be studied. The Joint Tactical Information Distribution System (JTIDS) Communication system architecture is currently being modeled; however, the computer software is modular enough to allow substitution of a new code representative of prospective communication protocols. GRA

N90-27030# Naval Underwater Systems Center, Newport, RI. Dept. of Weapon Systems Technology and Assessment.
A PRELIMINARY ANALYSIS OF THRESHOLD SIGNAL DETECTION IN AMBIENT AND SIGNAL-DEPENDENT NOISE ENVIRONMENTS Technical Document, Jul. 1988 - Feb. 1989
David Middleton 8 Jan. 1990 54 p
(Contract N66604-87-D-0546-0031)
(AD-A222089; NUSC/TD-8559) Avail: NTIS HC A04/MF A01 CSCL 20/1

Weak signal detection of signals scattered by ocean wave surfaces and reflecting bodies is examined. Optimum threshold algorithms, are determined, which contain in addition to the usual ambient background noise, signal-dependent noise generated in the scattering process. Threshold performance probabilities are formulated in terms of the now-generalized performance parameters associated with coherent and incoherent detection. As before, a canonical theory is presented, which is invariant of specific noise statistics and signal waveforms. Both spatial and temporal processing are included, the former implicitly in many cases by means of projected beam patterns. The physico-geometrical factors of platform motion, beam patterns, distributed scattering elements and source and receiver geometries for both the monostatic and bistatic regimes are summarized. Various distributed target models are presented, including quasi-phenomenological ones capable of analytic evaluation, involving both continuous and discrete scatterers. Under the present condition of narrow-band signals and far-field geometries, the input signal waveforms are explicitly separable from these physico-geometric factors. A weak target is assumed, in weak reverberation, vis-a-vis strong ambient noise. Sufficiently detailed analytic structure is provided to achieve explicit, quantitative results, and to guide the treatment of special problems. A short list of possible next steps is included. GRA

N90-27031# Naval Ocean Systems Center, San Diego, CA.
SPECIFICATION FOR HF LOWEST USABLE FREQUENCY (LUF) MODEL
T. N. Roy Mar. 1990 61 p Sponsored by Naval Oceanographic Office, Bay Saint Louis, MS
(AD-A222114; NOSC/TD-1753) Avail: NTIS HC A04/MF A01 CSCL 20/14

This report documents a high frequency (HF) lowest useable frequency (LUF) model called LUF. Developed at the Naval Ocean Systems Center, this semiempirical model permits simplified HF propagation predictions to be performed in near-real-time. The model predicts the LUF for arbitrary input values of receiver/transmitter position, date, time (UT), x ray flux level, transmitter power, transmitter and receiver antenna type, transmitter and receiver antenna bearing, and required signal-to-noise ratio. Several algorithms are contained in the model to describe the dependence of the LUF on these input parameters. An appendix contains the computer FORTRAN 77 code required to implement the fundamental features of this model. GRA

N90-27032# Naval Postgraduate School, Monterey, CA. Dept. of Electrical and Computer Engineering.
MEASURED EFFECTS OF REPEATER JAMMING ON DIRECT-SEQUENCE SPREAD SPECTRUM RECEIVERS THAT

USE ENVELOPE DETECTORS M.S. Thesis
Paul Evans Sep. 1989 67 p
(AD-A222231) Avail: NTIS HC A04/MF A01 CSCL 17/4

The effects of repeater jamming on a direct sequence spread spectrum communications system that uses an envelope detector were experimentally determined. A friendly signal transmitter, jamming signal transmitter, noiseless channel, and receiver were designed, built and tested. The spreading sequences of the friendly and jamming transmitters modulated a carrier to create an on-off keyed (OOK) signal. The OOK signal from the jammers was delayed and added to the friendly signal. The delays ranged from zero to 4 chips, and the J/S ratios ranged from -20 to 20 dB. This signal was then envelope detected and correlated with a replica of the spreading sequence of the transmitters. The results of the correlation show that in instances of high jamming and low jamming, reliable communication should occur. In cases where the jammer power and friendly signal power are nearly equal, the output of the correlator will not produce a signal that allows for correct tracking and therefore will not provide reliable communications. GRA

N90-27033# Scientific Systems, Inc., Woburn, MA.
ADAPTIVE TIME SERIES ANALYSIS USING PREDICTIVE INFERENCE AND ENTROPY Final Report, Dec. 1986 - Oct. 1989
Raman K. Mehra and Shah Mahmood 13 Feb. 1990 141 p
(Contract F49620-87-C-0026; AF Proj. 3005)
(AD-A222337; AFOSR-90-0289TR) Avail: NTIS HC A07/MF A01 CSCL 20/11

Research is reported on adaptive time series methods for detecting and tracking both abrupt and slow changes in both structure and parameters of dynamic systems. The methods are based on a unified statistical framework which is motivated by statistical inferences and entropy arguments. The method yields estimates of multivariate input/output dynamics and noise statistics. It also gives estimate of system order that is optimal in the sense of an information theoretic criterion. The integrated approach is known as CVA-AIC (Canonical Variate Analysis-Akaike Information Criteria). The relationship between this technique and another powerful framework for estimation known as E-M algorithmic approach was established. If the CVA-AIC technique is embedded properly in an E-M framework, it leads to maximum likelihood estimates and recursive algorithms for system identification. GRA

N90-27034# Naval Research Lab., Washington, DC. Radar Analysis Branch.
COMBINING ZERO DOPPLER FILTER CALCULATIONS WITH MTI FILTER CALCULATIONS TO INCREASE COMPUTATIONAL SPEED
Steven M. Brockett 8 May 1990 13 p Sponsored by Office of Naval Technology, Arlington, VA
(AD-A222468; NRL-MR-6638) Avail: NTIS HC A03/MF A01 CSCL 17/9

The implementation of zero Doppler filter in radar applications can be simplified to cause a substantial saving of computational time when an associated Moving Target Indicator (MTI) filter is computed. Because the zero Doppler filter is actually the MTI Filter shifted 180 degrees in the phase domain, the zero Doppler output of the filter can be derived from the MTI output. GRA

N90-27035# Voss Scientific, Albuquerque, NM.
DEPARTURES FROM PLANE-WAVE-LIKE COUPLING TO A MAVERICK MISSILE IN THE RADIATING NEAR-FIELD REGION OF A HORN ANTENNA Final Report
D. E. Voss, R. A. Koslover, C. D. Cremer, J. Silvestro, and L. M. Miner May 1990 22 p
(Contract F29601-86-C-0212; AF Proj. 5797)
(AD-A222539; WL-TR-90-04) Avail: NTIS HC A03/MF A01 CSCL 20/14

The High Power Microwaves (HPM) susceptibility testing often requires irradiating test objects at the highest fluences possible. For aperture antennas, the highest fluences are generally found in the radiating near field region. For valid effects testing, the energy coupled to the object interior must accurately replicate that which would occur in a true weapon environment (plane wave illumination). Some believe that valid testing requires object placement at distances from the aperture exceeding 2 D squared/lambda (D=antenna effective diameter). Many also believe testing at farther away than 2 D squared/lambda guarantees plane wave-like coupling conditions. Neither view is correct. Testing in the reactive field region (less than lambda from the aperture) is generally invalid due to dominance of reactive coupling. For testing in the radiating near field, determination of validity is less trivial. An investigation was performed quantifying deviations from plane wave coupling. The measurements, using an instrumented Maverick missile in an anechoic chamber, and supported by theory, indicate conditions for which testing the Maverick missile accurately simulates plane wave coupling. GRA

N90-27036# Ohio State Univ., Columbus. ElectroScience Lab.
HIGH RESOLUTION EXPONENTIAL MODELING OF FULLY POLARIZED RADAR RETURNS
W. E. Steedly and R. L. Moses Nov. 1989 61 p
(Contract N00014-86-K-0202)
(AD-A221432; ESL-718048-13) Avail: NTIS HC A04/MF A01 CSCL 17/9

This report considers a new method for modeling radar target scattering data for the purposes of automatic target recognition. The approach is to estimate a time (range) domain feature vector which describes the target. In particular, the target is characterized by a set of attributed scattering centers using the notion of a Transient Polarization Response; not only are scattering centers and their energies determined, but also their polarization effects on a circularly polarized incident wave, which are in general elliptical. An exponential model for the fully polarized radar return and an algorithm to estimate those parameters are presented. This algorithm is then applied to compact range measurements of aircraft models, and the results are presented and discussed. GRA

N90-27037# Electronics Research Lab., Adelaide (Australia).
METEOR BURST COMMUNICATIONS SYSTEMS
M. Irving and G. Silver Nov. 1989 28 p
(AD-A221675; ERL-0498-TR; DODA-AR-005-969) Avail: NTIS HC A03/MF A01 CSCL 04/1

The Earth's atmosphere is constantly bombarded by vast numbers of meteors, travelling at thousands of kilometres per hour. Upon entering the atmosphere, the friction of the air produces enough heat to completely vaporize these meteors. In the denser atmosphere at around 115 km altitude, the vaporized atoms collide with air molecules, producing a trail of free electrons. Complete vaporization generally occurs by 80 km altitude. This document presents a summary of Meteor Burst Communication Systems, based on the results of twenty-nine papers published between 1953 and 1988. It also includes information on the various modelling techniques employed. GRA

N90-27038# Air Force Human Resources Lab., Williams AFB, AZ.
SIMULATION OF SYNTHETIC APERTURE RADAR 4: SUMMARY AND RECOMMENDATIONS Final Technical Report, Jan. 1987 - Sep. 1989
Peter M. Crane and Herbert H. Bell Apr. 1990 10 p Prepared in cooperation with Air Force Human Resources Lab., Brooks AFB, TX
(AD-A221822; AFHRL-TR-89-64) Avail: NTIS HC A02/MF A01 CSCL 17/9

Four experiments were conducted to identify digital feature data base requirements for simulating synthetic aperture radar (SAR). The results indicate that lines of communication and large areal features are the principal cues used in SAR image interpretation. The results also indicate that depiction of small, individual features is required to create a simulation with acceptable realism. These small individual features may be depicted generically without adversely affecting SAR operator task performance. This approach

has been proposed by the Defense Mapping Agency (DMA) as the basis for a new Digital Feature Analysis Data (DFAD) product (Level 3-C) to support high-resolution radar simulation. We recommend that the Air Force accept the proposed Level 3-C DFAD specification for SAR simulation. GRA

N90-27144*# Lockheed Engineering and Sciences Co., Hampton, VA.
RADARS IN SPACE
Victor E. Delnore *In* NASA, Langley Research Center, Earth Sciences Requirements for the Information Sciences Experiment System Jul. 1990 p 45-59 (For primary document see N90-27140 21-43)
Avail: NTIS HC A10/MF A02 CSCL 17I

N90-27454# Microtel Pacific Research Ltd., Burnaby (British Columbia).
TACTICAL EHF SATELLITE COMMUNICATIONS FOR NATO EMPLOYING NON-GEOSTATIONARY ORBITS
M. Jamil Ahmed *In* AGARD, Tactical Applications of Space Systems May 1990 17 p (For primary document see N90-27438 21-66)
Copyright Avail: NTIS HC A07/MF A01; Non-NATO Nationals requests available only from AGARD/Scientific Publications Executive

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Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics.*

N90-27039 Department of the Navy, Washington, DC.
UNDERWATER CONNECT AND DISCONNECT PLUG AND RECEPTACLE Patent
Paul J. Dodier, inventor (to Navy) 13 Jun. 1989 3 p Filed 19 Jun. 1987
(AD-D014175; US-Patent-4,838,797; US-Patent-Appl-SN-67529; US-Patent-Class-439-038) Avail: US Patent and Trademark Office CSCL 09/1

A plug and receptacle combination is transformer coupled. There are no exposed contacts to the environment at any time, whether the plug and receptacle combination are mated or separated from each other. By encapsulating the primary winding and secondary winding separately in a respective plug and receptacle, mating and unmating can be accomplished while submerged in water. The inventive device is useful in any underwater activity in which a diver must attach a power cable to a power driven tool, light, pump, etc., while submerged. In addition submarines could have the receptacles installed outboard of the pressure hull to be used in the event it became disabled at a depth attainable by a diver. A diver could descend with cables and plug them into the receptacles providing power and communications to the stranded crew awaiting rescue. The inventions could also be used in the home as a safety device where no voltage would be exposed. Either the plug or the receptacle shown could be built into the wall. Whichever items is built into the wall would receive the power source and have the primary winding. GRA

N90-27040*# National Aeronautics and Space Administration. Pasadena Office, CA.
VLSI ARCHITECTURE FOR A REED-SOLOMON DECODER Patent Application
In-Shek Hsu, inventor (to NASA) and Trieu-Kie Truong, inventor (to NASA) (Jet Propulsion Lab., California Inst. of Tech., Pasadena.) 15 Feb. 1990 22 p
(Contract NAS7-918)
(NASA-Case-NPO-17897-1-CU; NAS 1.71:NPO-17897-1-CU; US-Patent-Appl-SN-480449) Avail: NTIS HC A03/MF A01 CSCL 09A

A basic single-chip building block for a Reed-Solomon (RS) decoder system is partitioned into a plurality of sections the first of which consists of a plurality of syndrome subcells each of which contains identical standard-basis finite-field multipliers that are programmable between 10 and 8 bit operation. A desired number of basic building blocks may be assembled to provide a RS decoder of any syndrome subcell size that is programmable between 10 and 8 bit operation. NASA

N90-27041*# National Aeronautics and Space Administration. Pasadena Office, CA.
METAL CHLORIDE CATHODE FOR A BATTERY Patent Application
Ratnakumar V. Bugga, inventor (to NASA), Salvador DiStefano, inventor (to NASA), and C. Berry Bankston, inventor (to NASA) (Jet Propulsion Lab., California Inst. of Tech., Pasadena.) 30 Mar. 1990 10 p
(Contract NAS7-918)
(NASA-Case-NPO-17809-1-CU; NAS 1.71:NPO-17809-1-CU; US-Patent-Appl-503409) Avail: NTIS HC A02/MF A01 CSCL 10C

A method of fabricating a rechargeable battery is disclosed which includes a positive electrode which contains a chloride of a selected metal when the electrode is in its active state. The improvement comprises fabricating the positive electrode by: providing a porous matrix composed of a metal; providing a solution of the chloride of the selected metal; and impregnating the matrix with the chloride from the solution. NASA

N90-27042*# National Aeronautics and Space Administration. Pasadena Office, CA.
IMPROVED HIGH POWER/HIGH FREQUENCY INDUCTOR Patent Application
W. T. McLyman, inventor (to NASA) (Jet Propulsion Lab., California Inst. of Tech., Pasadena.) 30 Nov. 1989 11 p
(Contract NAS7-918)
(NASA-Case-NPO-17830-1-CU; NAS 1.71:NPO-17830-1-CU; US-Patent-Appl-SN-443297) Avail: NTIS HC A03/MF A01 CSCL 09A

A toroidal core is mounted on an alignment disc having uniformly distributed circumferential notches or holes therein. Wire is then wound about the toroidal core in a uniform pattern defined by the notches or holes. Prior to winding, the wire may be placed within shrink tubing. The shrink tubing is then wound about the alignment disc and core and then heat-shrunk to positively retain the wire in the uniform position on the toroidal core. NASA

N90-27043# Department of Energy, Washington, DC. Office of Transportation Systems.
ELECTRIC AND HYBRID VEHICLES PROGRAM Annual Report No. 13, fiscal year 1989
Apr. 1990 41 p
(DE90-013560; DOE/CE-0285P) Avail: NTIS HC A03/MF A01

This thirteenth annual report on the implementation of the Electric and Hybrid Vehicle Research, Development and Demonstration Act of 1976 (Public Law 94-413), referred to as the Act, complies with the reporting requirements established in section 14 of the Act. In addition to informing Congress of the progress and plans of the Department of Energy's Electric and Hybrid Vehicles Program, this report is intended to serve as a communication link between the Department and all of the public and private interests involved in making the program a success. During FY 1989, significant progress was made in this program. There has been continuing interest shown by both the automobile manufacturers and supply sectors of our economy in electric and hybrid vehicles. The three major domestic automobile manufacturers all are devoting some effort towards electric vehicles. Their participation includes cost-shared contracts with Department of Energy and the Electric Power Research Institute as well as independently funded activities. Research and

development efforts in batteries and propulsion components continue to achieve significant progress in providing industry with technology that will result in vehicles that will be more economically competitive. DOE

N90-27044# Argonne National Lab., IL. Electrochemical Technology Program.
LIFE EVALUATION OF VALVE REGULATED LEAD-ACID BATTERIES FOR CYCLING APPLICATIONS
W. H. DeLuca, A. F. Tummillo, C. E. Webster, R. L. Hogrefe, and J. F. Miller 1990 6 p Presented at the 25th Intersociety Energy Conversion Engineering Conference, Reno, NV, 12-17 Aug. 1990 Sponsored in part by Electric Power Research Inst., Palo Alto, CA and International Lead Zinc Research Organization, New York, NY
(Contract W-31-109-eng-38)
(DE90-013649; CONF-900801-20) Avail: NTIS HC A02/MF A01

Argonne National Laboratory (ANL) is conducting a life evaluation of valve-regulated lead-acid (VRLA) batteries for cycling applications. Two technologies are being evaluated: (1) gelled-electrolyte modules from (JCI) Johnson Controls, Inc., and (2) absorbed electrolyte modules from GNB, Inc. A matrix of operating temperature and depth-of-discharge (DOD) conditions is being used to accelerate in the end-of-life for given modules. In May 1989, two modules from each manufacturer were placed on life test at 30 C (80 and 100 percent DOD), and third module was placed on accelerated life testing at 50 C (100 percent DOD). The GNB module operating to 100 percent DOD at 30 C still retains approximately 87 percent of its initial capacity after approximately 470 cycles. The GNB module operating to 80 percent DOD at 30 C has accrued approximately 600 cycles and retains approximately 92 percent of its initial 80 percent DOD capacity. After a high-temperature charge procedure was established, a fourth GNB module was placed on test at 50 C (80 percent DOD) in September 1989. Both GNB modules tested at 50 C have accrued approximately 170 cycles; the 100 percent DOD module retains approximately 84 percent of its initial capacity, and the 80 percent DOD module retains approximately 89 percent of its initial 80 percent DOD capacity. Only one of the gelled-electrolyte JCI modules remains on test 30 C, (80 percent DOD). It retains approximately 86 percent of its initial 80 percent DOD capacity after greater than 450 cycles. The other two JCI modules were removed from test because they reached end-of-life. Teardown analyses at JCI indicate that a manufacturing defect caused premature failure of one module. The second module is undergoing teardown analyses at ANL. DOE

N90-27045# Argonne National Lab., IL. Electrochemical Technology Program.
DEVELOPMENT OF A SEALED BIPOLAR LI-ALLOY/FeS2 BATTERY FOR ELECTRIC VEHICLES
T. D. Kaun, M. J. Duoba, K. R. Gillie, M. C. Hash, D. R. Simon, and D. R. Vissers 1990 7 p Presented at the 25th Intersociety Energy Conversion Engineering Conference, Reno, NV, 12-17 Aug. 1990
(Contract W-31-109-eng-38)
(DE90-013650; CONF-900801-19) Avail: NTIS HC A02/MF A01

Rapid progress is being made in the development of a bipolar Li-alloy/FeS2 battery with molten LiCl-LiBr-KBr electrolyte and MgO powder separator. Such a battery would be operated at 400 to 425 C and is expected to attain high performance and long cycle life (greater than 1000 cycles). An overcharge tolerant cell design safeguards the Li-alloys/FeS2 cells in the bipolar battery ad allows charge equalization with simple trickle charging. New ceramic materials have been developed for use as the peripheral hermetic seals required for electrolyte containment in bipolar cells. A stack of four bipolar Li-alloy/FeS2 cells with these seals has been operated for over 150 cycles. Projected performance for a prototype sealed bipolar Li-alloy/FeS2 battery is 191 Wh/kg specific energy and 500 W/kg peak specific power through 80 percent depth of discharge. Outstanding electric-vehicle performance can be expected from such a battery. DOE

N90-27046# Department of Energy, Washington, DC. Office of Transportation System.
ELECTRIC VEHICLE BATTERY R/D IN THE CONTEXT OF A PROPULSION SYSTEM
Pandit G. Patil, C. C. Christianson, and J. F. Miller (Argonne National Lab., IL.) 1989 7 p Presented at the Society of Automotive Engineers International Congress and Exposition, Detroit, MI, 27 Feb. - 3 Mar. 1989
(Contract W-31-109-eng-38)
(DE90-013667; CONF-890240-6) Avail: NTIS HC A02/MF A01

A battery system for an electric vehicle should be designed and developed in concert with the other components of the propulsion system. Technology development efforts sponsored by the U.S. Department of Energy are addressing all the constituent electric vehicle component technologies, including the battery subsystem technologies, from the perspective of the complete propulsion system. This approach is considered to be essential for three reasons. First, the ultimate viability of a given battery technology can only be assured in the context of a complete propulsion system. Second, many required battery subsystem technology advancements can only be addressed in concert with the other propulsion system components. Third, development and testing of battery subsystem technologies in conjunction with powertrain subsystem technology development is necessary in order to provide essential information to the battery developer and to the vehicle developer that can not be obtained when battery development is performed as a discrete activity. DOE

N90-27047# Air Force Systems Command, Wright-Patterson AFB, OH. Foreign Technology Div.
A COMPOSITION FOR THE FILLING OF GAS-DISCHARGE TUBES
G. I. Kromskiy and A. A. Mak 25 Apr. 1990 5 p Transl. into ENGLISH from Russian Patent, no. 431595, (29 Aug. 1972), p 1
(AD-A222818; FTD-ID(RS)T-0434-90) Avail: NTIS HC A02/MF A01 CSCL 20/5

The invention relates to illumination engineering and can be used for the optical pumping of the active medium of quantum generators. There is known a composition for the filling of gas-discharge tubes which contains vapors of alkali metal and inert gas (e.g., sodium and xenon). Low efficiency is a drawback in tubes with this filler. The proposed composition for the filling of gas-discharge tubes contains vapors of alkali metal and gaseous krypton. The greatest effect is obtained with the use of a composition which contains 0.1 atm of vapors of sodium and 50 atm of krypton. The efficiency of a tube with this composition exceeds that of the xenon tube by a factor of six. A composition for the filling of gas-discharge tubes which contains an inert medium and vapors of alkali metal is characterized by fact that for the purpose of increasing the efficiency in the tubes as the inert medium is selected krypton at a pressure 50 atm, while the vapors of the alkali metal, in particular sodium, are 0.1 atm. GRA

N90-27048# Vecht (Aron) and Associates, London (England).
THE PREPARATION OF ACEL THIN FILMS Final Report
Aron Vecht May 1990 14 p
(Contract DAJA45-89-C-0005)
(AD-A222919; R/D-5910-EE-01) Avail: NTIS HC A03/MF A01 CSCL 09/5

Although thin film ACEL devices have become commercially available, the number of companies producing these displays has continued to diminish. The cause of their demise was not display performance, as both sufficient brightness and efficiency has been achieved, but the low return on the heavy capital investment due to the poor yields obtained in production. In order to make ACEL thin film devices more viable, the capital investment needs to be low and/or the production yields high. Opting for relatively expensive sputtering or ALE techniques as the sole methods of fabricating EL structures, is both commercially and scientifically ill-advised. Considerable effort was spent in developing cheaper

alternative techniques for thin film deposition. The main objectives of the contract can be summarized as follows: (1) to deposit high quality ZnS thin films by MOCVD, (2) to dope the ZnS thin film with Mn, (3) to deposit high quality dielectric films using a novel spray pyrolysis process, (4) to evaluate optimized insulator/ZnS-Mn/insulator structures, and (5) the fabrication of large area XY matrix ACEL structures. GRA

N90-27049*# National Materials Advisory Board, Washington, DC.
MATERIALS FOR HIGH-DENSITY ELECTRONIC PACKAGING AND INTERCONNECTION Report, 1987 - 1990
10 Apr. 1990 154 p Sponsored by NASA, Washington
(Contract MDA903-89-K-0078)
(NASA-CR-186934; NAS 1.26:186934; AD-A222985; NMAB-449; LC-90-60385; ISBN-0-309-04233-X) Avail: NTIS HC A08/MF A01 CSCL 09/1

Electronic packaging and interconnections are the elements that today limit the ultimate performance of advanced electronic systems. Materials in use today and those becoming available are critically examined to ascertain what actions are needed for U.S. industry to compete favorably in the world market for advanced electronics. Materials and processes are discussed in terms of the final properties achievable and systems design compatibility. Weak points in the domestic industrial capability, including technical, industrial philosophy, and political, are identified. Recommendations are presented for actions that could help U.S. industry regain its former leadership position in advanced semiconductor systems production. GRA

N90-27050# Arizona State Univ., Tempe. Dept. of Electrical Engineering.
TRANSIENT SIGNAL DISTORTION AND COUPLING IN MULTILAYER MULTICONDUCTOR MIC MICROSTRIPS Final Report, 1 Apr. 1985 - 31 Mar. 1990
Constantine A. Balanis and James P. Gilb 23 May 1990 198 p
(Contract DAAG29-85-K-0078)
(AD-A222989; DWA-1682; ARO-21656.10-EL) Avail: NTIS HC A09/MF A02 CSCL 09/1

The frequency dependent characteristics of symmetric coupled microstrips in multilayer structures are considered in order to study transient signal distortion and coupling on these structures. Using the spectral domain approach with TEY (LSE) and TMY (LSM) modes, a simple recurrence relation is derived for the generalized Green's function of arbitrary multilayer structures. The frequency domain approach is used in conjunction with the even/odd mode analysis to formulate the time domain response for both of the coupled lines. Numerical results are presented for single layer structures, showing the effects of substrate materials, center conductor spacing, and line length. Results for multilayer structures are also given, showing the effects of additional substrates and superstrates on the line parameters. A new method for equalizing the even and odd phase velocities, and thus controlling the signal distortion and coupling, over a wide band of frequencies by properly selecting the dimensions and electrical properties of the substrate materials is presented. GRA

N90-27051# Army Engineer Waterways Experiment Station, Vicksburg, MS. Information Technology Lab.
DESIGN OF SHARP CUTOFF FILTERS WITH LOW QUALITY FACTORS Final Report
Michael G. Ellis May 1990 9 p
(AD-A223130; WES/MP/ITL-90-3) Avail: NTIS HC A02/MF A01 CSCL 09/1

Electronic filters are used to pass a band of frequencies while rejecting other frequencies. For example, tuning an FM radio is in effect tuning a filter that passes the signal from the desired FM station and blocks the signal from the undesired stations. Advances in technology call for filters with increasingly sharp cutoffs, and these filters are also increasingly difficult to manufacture. This difficulty arises from the fact that as the order of the filter is increased, the quality factor Q of each filter section is required to be correspondingly higher. A high Q filter can only be built by using components that closely approximate ideal components, which is often too expensive or not practical. This report presents a method of designing and building filters from low Q components that closely approximate the high Q models. GRA

N90-27052# Massachusetts Inst. of Tech., Cambridge. Dept. of Chemistry.
A VIOLOGEN/RUTHENIUM OXIDE-BASED MICROELECTROCHEMICAL DIODE WITH pH-DEPENDENT CURRENT-VOLTAGE CHARACTERISTICS Interim Technical Report, May 1989 - May 1990
Martin O. Schloh and Mark S. Wrighton 16 May 1990 39 p Submitted for publication Sponsored in part by DARPA
(Contract N00014-84-K-0553)
(AD-A221961; TR-38) Avail: NTIS HC A03/MF A01 CSCL 09/1

A procedure for selectively derivatizing two adjacent (approx. 1.4 microns apart) microelectrodes with RuOx and the redox polymer derived from hydrolysis of N,N'-bis(p-(trimethoxy silyl)benzyl)-4,4' bipyridinium dichloride, (BPQ2+), n' to yield a physical RuOx/(BPQ2+)n junction is reported. Such a junction functions as a pH-dependent diode by virtue of the redox properties of the materials employed. A diode-like current voltage curve obtains, because charge transport across the RuOx/(BPQ2+)n junction is effectively unidirectional: the oxidized RuOx can oxidize the reduced viologen, but the reduced RuOx can oxidize the reduced viologen. GRA

N90-27053# Massachusetts Inst. of Tech., Cambridge. Lab. for Electromagnetic and Electronic Systems.
LYAPUNOV-BASED CONTROL FOR SWITCHED POWER CONVERTERS
Seth R. Sanders and George C. Verghese Jun. 1990 9 p Presented at the IEEE Power Electronics Specialists Conference, San Antonio, TX, Jun. 1990 Sponsored in part by IBM Prepared in cooperation with California Univ., Berkeley
(Grant AF-AFOSR-0032-88; AF Proj. 2304)
(AD-A221974; LIDS-P-1969; AFOSR-90-0559TR) Avail: NTIS HC A02/MF A01 CSCL 10/2

Beginning with fundamental properties such as passivity or incremental passivity of the network elements comprising a switched power converter, the nominal open-loop operation of a broad class of such converters is shown to be stable in the large via a Lyapunov argument. The obtained Lyapunov function is then shown to be useful for designing globally stabilizing controls that include adaptive schemes for handling uncertain nominal parameters. Numerical simulations illustrate the application of this control approach in dc-dc converters. GRA

N90-27054# Massachusetts Inst. of Tech., Cambridge. Dept. of Chemistry.
CHARACTERIZATION OF A SOLID-STATE MICROELECTROCHEMICAL DIODE EMPLOYING A POLY(VINYL ALCOHOL)/PHOSPHORIC ACID SOLID-STATE ELECTROLYTE: RECTIFICATION AT JUNCTIONS BETWEEN WO3 AND POLYANILINE Interim Technical Report No. 36, May 1989 - May 1990
Nicholas Leventis, Martin O. Schloh, Michael J. Natan, James J. Hickman, and Mark S. Wrighton 16 May 1990 45 p Submitted for publication Sponsored in part by DARPA
(Contract N00014-84-K-0553)
(AD-A222025) Avail: NTIS HC A03/MF A01 CSCL 09/1

The functionalization of an array of eight, closely-spaced (1.2 microns) Pt or Au microelectrodes each 50 microns long, 2 microns wide, and 0.1 microns thick with redox active WO3 and polyaniline and the electrochemical characterization of the WO3/polyaniline junction is reported. Chips consisting of microfabricated WO3 covering three of the available eight microelectrodes have been analyzed by Auger electron spectroscopy. The remaining five microelectrodes are available for further derivatization with polyaniline or can function as counterelectrodes. GRA

N90-27055# Ceramic Process Systems Corp., Milford, MA.
COMPOSITE CERAMIC SUPERCONDUCTING WIRES FOR ELECTRIC MOTOR APPLICATIONS Quarterly Report No. 7, 1 Jan. - 31 Mar. 1990
John W. Halloran 30 Apr. 1990 79 p
(Contract N00014-88-C-0512; DARPA Order 9525)
(AD-A222085; CPS-90-010) Avail: NTIS HC A05/MF A01 CSCL 11/6

Silver clad polycrystalline Y-123 wire is being fabricated with a continuous reel-to-reel process. Scale-up activities are underway to produce enough wire for the field coils of the HTSC motor. Green HTSC fiber were produced in kilometer lengths, and sintered wires up to 166 meters long. The 77K Jc values are 1000-2800 A/sq cm in self field. To improve Jc of the Y-123 wire, development began on directional crystallization, including preliminary work at A. D. Little and Oak Ridge National Lab. Large lots of BiSCCO material were produced to fabricated fibers and sintered polycrystalline BiSSCO wire as rolled tape. Work continued in collaboration with Sandia and Los Alamos National Laboratories on rapid thermal processing of Y-123, with most emphasis on characterizing the rapid oxygenation effect. The design of the HTSC homopolar motor has been improved to increase the output from field coils by using six smaller coils, each with separately optimized current. Motor construction is in progress. Preliminary design is underway on a dc heteropolar motor with HTSC field windings and armature and a brushless trapped flux permanent magnet dc motor, in which the field is produced by trapped flux in an HTSC rotor. GRA

N90-27056# Pittsburgh Univ., PA. Surface Science Center.
BACKGROUND EFFECTS IN ESDIAD MEASUREMENTS ON Si(111)-(7X7)
R. M. Wallace, P. A. Taylor, M. J. Dresser, W. J. Choyke, and J. T. Yates, Jr. 21 May 1990 21 p Submitted for publication
(Contract N00014-82-K-0280)
(AD-A222242; TR-32) Avail: NTIS HC A03/MF A01 CSCL 09/1

The background effect in electron stimulated desorption ion angular distribution (ESDIAD) measurements due to soft x ray production on Si(111)-(7x7) is investigated. It was found that the background intensity from a Si(111)-(7x7) surface varies linearly with incident electron beam energy and current density. It is also found that the elimination of the background effect (by subtraction) plays a crucial role in both quantitative and qualitative interpretations of digital ESDIAD measurements on silicon, as well as to similar measurements on other surfaces. GRA

N90-27057# Harry Diamond Labs., Adelphi, MD.
ELECTRICAL RESISTANCE MEASUREMENTS OF CONNECTOR-PANEL INTERFACES
Steven Blomquist May 1990 4 p
(AD-A221431; HDL-TL-90-3) Avail: NTIS HC A01/MF A01 CSCL 14/2

This report indicates construction methods which would assure both vacuum and electrical-grounding integrity of the subminiature series A (SMA) vacuum bulkhead feedthrough connectors. This investigation was initiated in response to the finding that some of the connectors on the nonupsettable computer modules were not thoroughly grounded. This report presents the results of resistivity measurements on several selected conducting panel materials and several configurations of feedthroughs. The information reported is organized into procedures used to acquire the data, test results, and recommendations. Specific recommendations are made for the best materials and parts to achieve low resistance and a hermetic seal. Also, designs are recommended for the O-ring and groove design on bulkhead hermetic feedthroughs. GRA

N90-27058# Cornell Univ., Ithaca, NY. Dept. of Materials Science and Engineering.
ION BEAM PROCESSING OF DIAMOND Final Technical Report, 1 Nov. 1988 - 30 Jun. 1989
James W. Mayer 7 May 1990 11 p
(Contract N00014-87-K-0263)
(AD-A221475) Avail: NTIS HC A03/MF A01 CSCL 09/1

The objective of this work was to make an ohmic contact to diamond by the graded band gap concept whereby a smaller band semiconductor is intermixed epitaxially onto a larger band gap material. All three aspects of the program were successful: (1) The Cornell group carried out or provided facilities for ion beam deposited at other laboratories, (2) The UCSD group formed ohmic contacts to diamond by depositing Si on Diamond and ion-mixing, (3) The Cornell group demonstrated compound formation between Ni and BP (boron phosphide) which was chosen as a prototype of a high melting point refractory semiconductor with a wide band gap for evaluation of ion beam mixing. GRA

N90-27059# Brimrose Corp. of America, Baltimore, MD.
FABRICATION OF MICROWAVE GUIDES USING HIGH Tc SUPERCONDUCTORS Final Report, 15 Jul. 1989 - 14 Jan. 1990
Sudhir B. Trivedi, Yu-Jung Huang, Robert D. Rosemeier, and Daniel Handley 14 Jan. 1990 37 p
(Contract F49620-89-C-0111)
(AD-A221560; AFOSR-90-0510TR) Avail: NTIS HC A03/MF A01 CSCL 09/1

The objective of this study was to produce bulk high Tc superconductor YBa2Cu3O7-x with microwave conductivity at least as good or better than that of copper. The subsequent aim was to fabricate a cylindrical wave guide using this material. The ultimate goal of this study is to produce YBa2Cu3O7-x with microwave conductivity exceedingly higher (at least two orders of magnitude better) than that of copper. In principle, this is possible if the microstructure of the superconductor material is carefully controlled. The above-stated goal could be easily achieved if the large single crystals of YBa2Cu3O7-x are available or if the inside surface of a suitable substrate material in the form of hollow cylinder, could be coated with the superconductor material of high quality. The former approach, currently, seems to be far from practical realization. GRA

N90-27060# Naval Postgraduate School, Monterey, CA. Dept. of Electrical and Computer Engineering.
NOISE ADAPTATION AND CORRELATED MANEUVER GATING OF AN EXTENDED KALMAN FILTER M.S. Thesis
Stephen L. Spehn Mar. 1990 148 p
(AD-A221713) Avail: NTIS HC A07/MF A01 CSCL 20/3

Extended Kalman filtering is used to provide estimates of the position and velocity of a target based upon observations of the target's bearing and range. Nonstationary noise is shown to degrade the performance of the filter and cause filter divergence. By estimating the noise power from the variance of the filter's residual we adapt the filter to compensate for varying noise power. The method of correlated maneuver gating to adapt the Kalman filter to target dynamics is also introduced. By spatially and temporally correlating the Mahalanobis Distance of the residual, the Kalman filter's performance is increased while tracking tangentially accelerating targets. Monte Carlo simulations are run for three different sets of target dynamics: stationary, moving linearly, and accelerating tangentially. Results for the simulation show significant performance advantages of using correlated maneuver gating in conjunction with noise adaptation. These results should generalize to other applications of the extended Kalman filter whose state and observation spaces enjoy a one-to-one mapping. GRA

N90-27061# Mission Research Corp., Albuquerque, NM.
SUBTHRESHOLD TECHNIQUE FOR FIXED AND INTERFACE TRAPPED CHARGE SEPARATION IN IRRADIATED MOSFETS Technical Report, 28 Feb. 1987 - 10 Mar. 1988
Edward W. Enlow, Ronald L. Pease, and David R. Alexander 1 Apr. 1990 99 p
(Grants DNAAL02-86-D-0043; DNA-MIPR-89-500)
(AD-A221861; MRC/ABQ-R-1069; DNA-TR-89-157) Avail: NTIS HC A05/MF A01 CSCL 09/1

The use is reviewed of the subthreshold charge separation

technique for analysis of ionizing degradation of gate dielectrics in MOSFETs and isolation oxide degradation in parasitic FETs. The subthreshold technique is used to separate radiation induced threshold voltage shifts into voltage shifts due to oxide trapped holes and interface states. The theory and assumptions of this technique are discussed in detail. The application is discussed with respect to electrical measurements and data analysis. Limitations in the application with regard to interferences from leakage and violations of assumptions are presented. In the appendix, a proposed measurement and data analysis standard is given. GRA

N90-27062# Maryland Univ., College Park. Inst. for Advanced Computer Studies.
FINDING MINIMUM WIDTH FOR SINGLE-LAYER CHANNEL ROUTING IN LINEAR TIME
Ronald I. Greenberg and F. Miller Maley (Princeton Univ., NJ.) Jan. 1990 13 p
(Contract N00014-87-K-0825; NSF DMS-87-05835)
(AD-A221876; UMIACS-TR-90-4; CS-TR-2386) Avail: NTIS HC A03/MF A01 CSCL 09/1

In recent years, a good deal of attention has been given to the problem of planar or single-layer wire routing for VLSI chips. Especially popular has been river routing in the restricted sense of the term, i.e., the connection of two parallel rows of corresponding points. Other works have considered routing within a rectangle placement and routing within a ring of pads or routing between very general arrangements of modules. It is shown that the minimum separation problem (in the rectilinear wiring model) can be solved in linear time for any single layer channel routing problem, even with single sided connections. In the process, a linear time solution is provided to the routability problem which simply asks whether a routing is possible given a fixed vertical separation as well as fixed horizontal positions of the terminals. Generalization from channels to switchboxes is briefly discussed which demonstrates a simple routability test for switchboxes. Comparable results could be obtained fairly directly from the work of Cole and Siegel, a simpler exposition is given by concentrating on the special cases of channels and switchboxes. Detailed but concise pseudocode is provided for the channel separation problem. GRA

N90-27063# Nationaal Inst. voor Kernfysica en Hoge Energiefysica, Amsterdam (Netherlands).
A 6.4 kV PULSE GENERATOR WITH TRANSFORMERS Report, Sep. - Dec. 1988 [6,4 KV PULSGENERATOR MET TRANSFORMATOREN, SEPTEMBER-DECEMBER 1988]
W. L. Bastein 1989 23 p In DUTCH
(DIGEL-1989-1; ETN-90-97267) Avail: NTIS HC A03/MF A01

The possibility of producing a 6.4 kV voltage pulse using transformers was investigated. The pulse has to have a rise and fall time of 100 ns, a pulse duration of 2 to 50 microns, a repetition frequency of 2500 Hz, and a ripple of less than 10 V. It is shown that it is in principle possible, using transformers for the low frequency and high frequency parts of the pulse, to produce a pulse which fulfills the slope requirements. However, it is difficult to make and tune the circuits to flatten the pulse sufficiently. The losses are so high that it is recommended to investigate the possibility of producing the pulse with a number of MOSFET's in series. ESA

34 FLUID MECHANICS AND HEAT TRANSFER

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics.*

N90-27064*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
A REVIEW OF REACTION RATES AND THERMODYNAMIC AND TRANSPORT PROPERTIES FOR AN 11-SPECIES AIR MODEL FOR CHEMICAL AND THERMAL NONEQUILIBRIUM CALCULATIONS TO 30000 K
Roop N. Gupta, Jerrold M. Yos, Richard A. Thompson, and Kam-Pui Lee (Scientific Research and Technology, Inc., Hampton, VA.) Washington Aug. 1990 90 p
(NASA-RP-1232; L-16634; NAS 1.61:1232) Avail: NTIS HC A05/MF A01 CSCL 20D

Reaction rate coefficients and thermodynamic and transport properties are reviewed and supplemented for the 11-species air model which can be used for analyzing flows in chemical and thermal nonequilibrium up to temperatures of 3000 K. Such flows will likely occur around currently planned and future hypersonic vehicles. Guidelines for determining the state of the surrounding environment are provided. Curve fits are given for the various species properties for their efficient computation in flowfield codes. Approximate and more exact formulas are provided for computing the properties of partially ionized air mixtures in a high energy environment. Limitations of the approximate mixing laws are discussed for a mixture of ionized species. An electron number-density correction for the transport properties of the charged species is obtained. This correction has been generally ignored in the literature. Author

N90-27065 Clarkson Univ., Potsdam, NY.
ON THE LINEAR AND NONLINEAR STABILITY OF NON-PARALLEL FLOW Ph.D. Thesis
Haibo Chen 1989 232 p
Avail: Univ. Microfilms Order No. DA8918264

Due to theoretical and practical demands, the stability of nonparallel flows have received increasing attention recently. Two nonparallel exact solutions to the Navier-Stokes equations are chosen as the basic flow: the Taylor vortex array and the Kovasznay flow. In Part 1, the linear stability analysis of the Taylor vortex array is formulated. By use of the spectral Galerkin method, we reduced the governing equation of linear into 4 independent modes. In each mode, vortices break down in a different manner. The time evolution of the streamline patterns of the decaying vortices under the influence of disturbances are given. In Part 2, the linear and nonlinear stability analyses of another nonparallel exact solution to the Navier-Stokes equations, the Kovasznay flow, are also formulated. A new approach to the problem is given. For the semi-infinite computational domain, the rational Chebyshev function was used as the base functions. The linear stability analysis of the Kovasznay flow is performed with respect to the odd-rational Chebyshev mode and the even-rational Chebyshev mode. An organized structure seems to develop after the onset of instability. The importance of the secondary stability is recognized through this work. Several general characteristics of nonparallel flow stability are found. Author

N90-27066*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
AN APPROXIMATE METHOD FOR CALCULATING THREE-DIMENSIONAL INVISCID HYPERSONIC FLOW FIELDS
Christopher J. Riley and Fred R. DeJarnette Washington Aug. 1990 26 p
(NASA-TP-3018; L-16745; NAS 1.60:3018) Avail: NTIS HC A03/MF A01 CSCL 20D

An approximate solution technique was developed for 3-D inviscid, hypersonic flows. The method employs Maslen's explicit

pressure equation in addition to the assumption of approximate stream surfaces in the shock layer. This approximation represents a simplification to Maslen's asymmetric method. The present method presents a tractable procedure for computing the inviscid flow over 3-D surfaces at angle of attack. The solution procedure involves iteratively changing the shock shape in the subsonic-transonic region until the correct body shape is obtained. Beyond this region, the shock surface is determined using a marching procedure. Results are presented for a spherically blunted cone, paraboloid, and elliptic cone at angle of attack. The calculated surface pressures are compared with experimental data and finite difference solutions of the Euler equations. Shock shapes and profiles of pressure are also examined. Comparisons indicate the method adequately predicts shock layer properties on blunt bodies in hypersonic flow. The speed of the calculations makes the procedure attractive for engineering design applications. Author

N90-27067# National Inst. of Standards and Technology, Gaithersburg, MD.

NUMERICAL METHOD FOR CALCULATING INDOOR AIRFLOWS USING A TURBULENCE MODEL

T. Kurabuchi (Tokyo Univ., Japan), J. B. Fang, and Richard A. Grot Jan. 1990 123 p

(PB90-162009; NISTIR-89/4211) Avail: NTIS HC A06/MF A01 CSCL 20D

A numerical method is described for simulating indoor air flows in a building using a k-epsilon turbulence method. The model treats 3-D non-iso-thermal turbulent flows using the Boussinesq approximation for buoyance. The resulting nonlinear system of momentum, energy and turbulence equations are solved by an explicit time marching technique to obtain a solution to either a steady state or transient flow. An upwind/central combination scheme with arbitrary specification for the switching parameter is used to approximate the convective terms. This switching parameter can be specified at each point in the flow regime allowing for different strategies in different flow regions. The switching technique includes both the central and hybrid schemes found in the literature. A pressure relaxation method is used to satisfy the Poisson equation for continuity. The model handles a variety of flow, pressure, temperature and heat flux boundary conditions including prescribed inflows, outflows by either prescribing the flow or pressure, wall boundary conditions together with heat flux and temperature and/or heat transfer coefficients specified on the boundary. Volumetric heat sources can also be included. The model has the ability of handling an arbitrary number of obstacles in the flow region. Author

N90-27068# Wichita State Univ., KS. Inst. for Aviation Research.

TOWARD THE OPTIMIZATION OF A NON-DIFFUSING, TWO-DIMENSIONAL S-SHAPED DUCT Ph.D. Thesis

Brian J. Kitchen May 1989 137 p

(Contract DAAL03-87-G-0003)

(IAR-89-3) Avail: NTIS HC A07/MF A01

The design of 2-D, non-diffusing, S-shaped ducts is studied with an emphasis on the optimization of duct shape, given the duct offset-to-length ratio and gap-to-length ratio as design parameters. Offset is defined as the cross-stream distance from inlet to exit center-lines and gap is defined as the constant radial spacing between the curved duct walls. The optimum duct is defined as that duct which is least prone to separation. Truckenbrodt's boundary layer integral method, used in conjunction with a numerical potential flow program, was the means for evaluating the duct flow in terms of nearness to separation. To evaluate the results of the integral method, an experimental duct was built and tested using laser-Doppler anemometry in conjunction with a set of static pressure taps along each of the two curved walls. A comparison of experimental and computational results is presented. Duct geometries were based on the path that a constant-speed particle would follow when subjected to a certain prescribed normal acceleration function. Computational studies suggested that an S-shaped duct design based on a constant-amplitude, constant-frequency normal acceleration function exhibited optimum behavior when the first turn was completed in approximately 37 percent of the overall horizontal duct length, regardless of the value of the offset-to-length ratio. A variable-amplitude, variable-frequency normal acceleration function resulted in a duct of better performance that the above described 37 percent duct. However, the general configurations of the two optimal ducts are similar in that the first turn in the S-shaped duct is appreciably sharper than the second, reverse turn. Author

N90-27069# National Aerospace Lab., Amsterdam (Netherlands). Fluid Dynamics Div.

NUMERICAL INTERACTIVE GRID GENERATION FOR 3-D FLOW CALCULATIONS

J. M. J. W. Jacobs, A. Kassies, J. W. Boerstoel, F. Buijsen, and J. L. Kuijvenhoven (Fokker B.V., Amsterdam, Netherlands) 25 Aug. 1988 23 p Presented at 2nd International Conference on Numerical Grid Generation in Computational Fluid Dynamics, Miami Beach, FL, 5-8 Dec. 1988 Previously announced in IAA as A90-26556

(Contract NIVR-01604N)

(NLR-MP-88055-U; ETN-90-97190) Avail: NTIS HC A03/MF A01

A method for the generation of three-dimensional block-structured grids is described. The grid generation process is decomposed into two major stages: block decomposition of the flow domain and construction of a grid in each block. Examples of grids are shown together with flow solver results. Improvements and future extensions of the present concepts are discussed. ESA

N90-27070*# National Aeronautics and Space Administration. Pasadena Office, CA.

ADJUSTABLE CHOKE FOR FLUIDS NOZZLE Patent Application

Andrew D. Morrison, inventor (to NASA) (Jet Propulsion Lab., California Inst. of Tech., Pasadena.) 31 May 1990 14 p

(Contract NAS7-918)

(NASA-Case-NPO-17625-1-CU; NAS 1.71:NPO-17625-1-CU; US-Patent-Appl-SN-531434) Avail: NTIS HC A03/MF A01 CSCL 20D

A self-adjusting choke for fluids nozzle includes a membrane constructed of a single piece of flexible or elastic material. This flexible material is shaped to fit into the outlet of a nozzle. The body of the membrane has at least two flow channels, from one face to the other, which directs two streams of water to cross at the opening of the nozzle or at some point beyond. The elasticity and thickness of the membrane is selected to match the range of expected pressures and fluid velocities. The choke may have more than two flow channels, as long as they are aligned adjacent to one another and directed towards each other at the exit face. In a three orifice embodiment, one is directed upward, one is directed downward, and the one in the middle is directed forward. In this embodiment all three fluid streams intersect at some point past the nozzle opening. Under increased pressure the membrane will deform causing the orifices to realign in a more forward direction, causing the streams to intersect at a smaller angle. This reduces the force with which the separate streams impact each other, still allowing the separate streams to unify into a single stable spiralling stream in spite of the increased pressure. NASA

N90-27071*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.

HYDRODYNAMIC SKIN-FRICTION REDUCTION Patent Application

Jason C. Reed, inventor (to NASA) (Old Dominion Univ., Hampton, VA.), Dennis M. Bushnell, inventor (to NASA), and Leonard M. Weinstein, inventor (to NASA) 31 Oct. 1989 18 p

(NASA-Case-LAR-14078-1-CU; NAS 1.71:LAR-14078-1-CU; US-Patent-Appl-SN-429737) Avail: NTIS HC A03/MF A01 CSCL 20D

A process for reducing skin friction, inhibiting the effects of liquid turbulence, and decreasing heat transfer in a system involving flow of a liquid along a surface of a body includes applying a

substantially integral sheet of a gas, e.g., air, immediately adjacent to the surface of the body; a marine vehicle, which has a longitudinally grooved surface in proximity with the liquid and with a surface material having high contact angle between the liquid and said wall to reduce interaction of the liquid; water, with the surface of the body; and the hull of the marine vehicle. NASA

N90-27072*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
HEAT EXCHANGER WITH OSCILLATING FLOW Patent Application
Stephen J. Scotti, inventor (to NASA), Max L. Blosser, inventor (to NASA), and Charles J. Camarda, inventor (to NASA) 30 Mar. 1990 21 p
(NASA-Case-LAR-14033-1; NAS 1.71:LAR-14033-1; US-Patent-Appl-SN-501909) Avail: NTIS HC A03/MF A01 CSCL 20D

Various heat exchange apparatuses are described in which an oscillating flow of primary coolant is used to dissipate an incident heat flux. The oscillating flow may be imparted by a reciprocating piston, a double action twin reciprocating piston, fluidic oscillators or electromagnetic pumps. The oscillating fluid flows through at least one conduit in either an open loop or a closed loop. A secondary flow of coolant may be used to flow over the outer walls of at least one conduit to remove heat transferred from the primary coolant to the walls of the conduit. NASA

N90-27073# Scientific Research Associates, Inc., Glastonbury, CT.
ROTATING FLOW IN RADIAL TURBOMACHINERY Final Report, Oct. 1985 - Feb. 1990
T. R. Govindan, F. J. DeJong, W. R. Briley, and H. McDonald May 1990 28 p
(Contract DAAG29-85-C-0030)
(AD-A222885; SRA-R930011-F; ARO-22360.4-EG-S) Avail: NTIS HC A03/MF A01 CSCL 20/4

The present study addresses the development and implementation of computational procedures for analysis and prediction of flows in centrifugal impellers. Two approaches have been investigated: (1) solution of the Navier-Stokes equations, and (2) solution of an approximate set of viscous primary/secondary flow equations by an efficient spatial marching algorithm. Solution of the Navier-Stokes equations has been directed towards computing the flow field in a rotating centrifugal impeller passage. Computed results show all the flow features of measurements. The spatial marching approach was directed towards derivation of approximate flow equations and development of an efficient solution algorithm suitable for computing impeller flow fields. Flow in a rotating 90-degree bend was used as a test case for the spatial marching approach. Computer results for the rotating duct show characteristic features of impeller flow fields. GRA

N90-27074# Air Force Inst. of Tech., Wright-Patterson AFB, OH. School of Engineering.
THERMAL ANALYSIS OF HEAT PIPE RADIATORS WITH A RECTANGULAR GROOVE WICK STRUCTURE M.S. Thesis
Chul Hwan Yang Jun. 1990 92 p
(AD-A222952; AFIT/GA/ENY/90J-02) Avail: NTIS HC A05/MF A01 CSCL 13/1

Performance of a grooved heat pipe radiator has been analyzed to determine its operating characteristics. A heat transfer analysis for the heat pipe is coupled with the analysis of the fin in this study. The effects of heat pipe operating temperature on heat flux and fin efficiency are investigated. Finite difference expressions are used for the grid system of the heat pipe wall and the fin. The heat transfer coefficient of the heat pipe radiator was determined as a function of the operating temperature level. Realistic numerical results were achieved and it was shown that the required heat flux and the temperature difference between the evaporator and condensor both increase with operating temperature. Also, the heat transfer coefficient increased with operating temperature up to a certain point, then began to level-off near a temperature of approximately 400 K. In addition, the overall efficiency of the heat pipe-fin arrangement decreased as the operating temperature level increased. GRA

N90-27075# Cornell Univ., Ithaca, NY. Dept. of Chemistry.
VARIABLE LENGTH-SCALE STUDIES AT INTERFACES WITH X RAY STANDING WAVES
H. D. Abruna, G. M. Bommarito, and D. Acevedo 4 Jun. 1990 42 p
(Contract N00014-84-K-0656)
(AD-A223043; TR-18) Avail: NTIS HC A03/MF A01 CSCL 14/2

The principles and applications of the x ray standing wave technique are described. Emphasis is placed on its use as a variable length-scale probe for the study of structure composition and distribution of interfacial species especially at solid/liquid interfaces. GRA

N90-27076# Ohio State Univ., Columbus. Dept. of Electrical Engineering.
THREE-DIMENSIONAL STRUCTURE OF BOUNDARY LAYERS IN TRANSITION TO TURBULENCE Final Report, Apr. 1988 - Mar. 1989
Thorwald Herbert Mar. 1989 157 p
(Grant AF-AFOSR-0186-88; AF Proj. 2307)
(AD-A223242; AFOSR-90-0728TR) Avail: NTIS HC A08/MF A01 CSCL 20/4

A spectral code for linear stability analysis was developed that allows easy adaptation to a large variety of basic flows and stability equations. This code is the basis for extensions to analyze secondary and nonlinear stability in parallel and nonparallel flows. Improved numerical techniques were developed to reduce the computational demand of secondary instability studies. A new approach to convective instability analysis in nonparallel flows on the basis of parabolized stability equations was developed for incompressible and compressible flows. Encouraging results were obtained in the areas of linear, nonlinear, and secondary instability. The code appears as a viable alternative to DNS codes that allows transition simulations at a small fraction of the computational cost. Author

N90-27077# R and D Associates, Marina Del Rey, CA.
INVISCID DYNAMICS OF UNSTABLE SHEAR LAYERS Technical Report, 1 Aug. 1987 - 1 Aug. 1988
A. Kuhl, K. Y. Chien, R. E. Ferguson, H. M. Glaz, and P. Colella 1 Apr. 1990 78 p
(Contract DNA001-88-C-0046)
(AD-A222297; RDA-TR-161-4-006; DNA-TR-89-6) Avail: NTIS HC A05/MF A01 CSCL 20/4

Numerical simulations are described for three idealized shear layer problems typical of shock reflection flow fields: free shear layers (corresponding to a slip line emanating from a triple point), a wall shear layer (approximating a boundary layer behind a shock), and a wall jet (similar to those found in precursor and double-Mach-stem flows). The dynamic evolution of the shear layers was followed by means of numerical solutions of the inviscid conservation laws of gasdynamics. The inviscid shear layer discontinuity was de-singularized by initializing the flowfield with a Tanh(y) velocity profile that, in effect, allows one to resolve the shear layer on the computational mesh. The inflow velocity profile was then perturbed with the fundamental frequency (from linear stability analysis) and its subharmonics. The macroscopic features of the calculations (e.g., the formation and growth of large-scale rotational structures, the visual spreading rates, and the mean flow profiles) agree quantitatively with the available experimental data. The fluctuating flow components agree qualitatively (e.g., the peak velocity fluctuations can be 1.5 to 2 times larger than the data, because of the two-dimensional flow approximation). These calculations demonstrate that the fluctuating, time-dependent flow variations observed in such problems are caused by the dynamic evolution of unstable shear layers, and that the dynamics is dominated by inviscid effects for such large-Reynolds-number flows. GRA

N90-27078# Lehigh Univ., Bethlehem, PA. Dept. of Mechanical Engineering and Mechanics.
VORTEX-INDUCED BOUNDARY LAYER SEPARATION Interim Report, Nov. 1988 - Oct. 1989
Vallorie J. Peridier and James David Walker Oct. 1989 337 p (Contract F49620-85-C-00108; AF-AFOSR-0065-89; AF Proj. 2307)
(AD-A221564; FM-13; AFOSR-90-0458TR) Avail: NTIS HC A15/MF A02 CSCL 20/4

Unsteady boundary-layer separation at high Reynolds numbers, Re, is considered on a theoretical and computational basis. Whenever an external inviscid flow induces a region of adverse pressure gradient near a wall, the development of recirculating eddies in the boundary layer is common. An unsteady viscous-inviscid interaction often follows in the form of a local boundary-layer eruption and abrupt ejection of near-wall vorticity into the external flow. The dynamics of this process, as it develops in an initially thin boundary layer, is considered. As interaction ensues, the flow focuses into a band which progressively narrows in the streamwise direction. The complex flow development is extremely difficult to resolve using conventional Eulerian methods; here the boundary-layer solutions are obtained using Lagrangian methods, wherein trajectories of a large number of fluid particles are computed. The algorithms developed are general but are applied here to the problem of the boundary-layer induced by a two-dimensional vortex above an infinite plane wall. Solutions are obtained for the limit problem Re approaches limit of infinity, and for Re large but finite using an interacting boundary-layer approach. The present results describe the initial stages of a strong unsteady viscous-inviscid interaction; apparently it is necessary to account for the effect of normal pressure variations to continue the interaction. GRA

N90-27079# California Univ., Los Angeles. Dept. of Mechanical Aerospace and Nuclear Engineering.
LOCAL AND GLOBAL RESONANCES IN HEATED 2-D JETS Final Report, 1 Sep. 1987 - 31 Jul. 1989
Ming Huei Yu and Peter A. Monkewitz Nov. 1989 77 p (Grant AF-AFOSR-0329-87; AF Proj. 2307)
(AD-A221671; AFOSR-90-0455TR) Avail: NTIS HC A05/MF A01 CSCL 20/4

The connection between local and global stability properties of free shear flows was investigated. For 2-D inviscid jets, absolute instability was found for ratios of jet to ambient density below 0.9. Low wake heating (density) eliminates all local absolute instability. In 2-D heated jets, experiments showed that local absolute instability does lead to global instability and self-excitation at a density ratio of 0.9. The flow was documented with Schlieren and mean velocity and temperature measurements. The global linear stability of a slowly diverging inviscid shear flow has been theoretically analyzed by WKB methods. Global characteristics are found, under certain assumptions, to be determined by a region where the absolute frequency of the mode with zero group velocity has a saddle. GRA

N90-27080# Ohio State Univ., Columbus. Dept. of Mathematics.
MODELING OF FREE VISCOELASTIC JETS AND INSTABILITY MECHANISMS Final Report, 1 Apr. 1988 - 31 Mar. 1990
Greg Forest and Stephen Bechtel Mar. 1990 7 p (Grant AF-AFOSR-0164-88; AF Proj. 2304)
(AD-A221672; AFOSR-90-0448TR) Avail: NTIS HC A02/MF A01 CSCL 20/4

Analytical, numerical, and experimental studies were made of non-Newtonian fluids. The results are summarized. GRA

N90-27081# Ballistic Research Labs., Aberdeen Proving Ground, MD.
ON THE SPATIAL EIGENVALUE APPROACH TO HIGH REYNOLDS NUMBER FLOW IN A ROTATING AND NUTATING CYLINDER Technical Report, Nov. 1987 - Nov. 1989
Philip Hall (Exeter Univ., England), Raymond Sedney, and Nathan Gerber Apr. 1990 41 p
(AD-A221710; BRL-TR-3092) Avail: NTIS HC A03/MF A01 CSCL 20/4

The spatial eigenvalue expansion procedure which was used previously to study viscous flow in rotating and nutating cylinders is studied in the high Reynolds number limit. It is shown that in this limit there is a significant simplification in the procedure used to determine the amplitudes of the eigenfunctions used to describe the forced velocity field in the cylinder. More precisely, it is shown that these amplitudes can, to the order of Reynolds number used, be simply expressed in terms of Bessel functions. The method is used to calculate the pressure coefficient at a point on the endwall. Detailed comparisons with experimental results are made. It is found that the approach provides an accurate and extremely rapid way of determining this pressure coefficient. GRA

N90-27082# Ballistic Research Labs., Aberdeen Proving Ground, MD.
PARALLEL NUMERICAL SIMULATIONS OF AXISYMMETRIC PROJECTILE FLOWS USING ZONAL-OVERLAPPED GRIDS Final Report, Jul. 1986 - Jul. 1988
Nisheeth R. Patel and Walter B. Sturek May 1990 65 p
(AD-A221711; BRL-MR-3834) Avail: NTIS HC A04/MF A01 CSCL 20/4

Recent developments in vector and parallel computer architectures provide the potential for achieving greatly enhanced computational speed in the execution of fluid dynamic flow solvers. In order to explore techniques for efficient use of these computer architectural features and to develop an improved capability for modeling highly irregular projectile geometries, the development of a zonal Navier-Stokes computational code was undertaken. This report documents the initial development and validation of this code. The code employs a multi-zone overlapped grid technique and uses MacCormack's explicit finite-differences numerical algorithm. Parallel execution features are incorporated within the code that permit implementation on both distributed and shared memory multiprocessors. The code has been applied to several challenging test problems, in particular, the application to a ramjet configuration with a highly complex internal flow which is discussed in detail. The computational results are compared with experimental measurements. The code has been found to provide for efficient utilization of vector/parallel computer architectures. Also, the zonal flow field topology has proven to be well suited for configurations with irregular geometries. GRA

N90-27083# Indiana Univ., Bloomington. Dept. of Mathematics.
THEORETICAL AND COMPUTATIONAL ASPECTS OF TURBULENCE Final Report, 1 Jan. 1988 - 31 Dec. 1989
Ciprian I. Foias and Roger Temam 27 Feb. 1990 7 p (Grant AF-AFOSR-0103-88; AF Proj. 2304)
(AD-A221795; AFOSR-90-0484TR) Avail: NTIS HC A02/MF A01 CSCL 20/4

The computation of turbulent flows necessitates a better understanding of turbulence and the development of algorithms and computational tools which are well-adapted to the handling of large numbers of data. Turbulent flows are due to the superposition of a range of small and large eddies which interact, and the study of their interaction is an important part of understanding turbulence. An inertial manifold is an exact (quasi-static) interaction law between small and large eddies. In relation with the concept of approximate inertial manifolds (AIM), Foias-Manley-Temam have shown the existence of a simple finite-dimensional manifold lying close to the attractor. By projecting the Navier-Stokes equations on this manifold, we obtain a new numerical algorithm called the Nonlinear Galerkin Method. This algorithm is well-adapted to the large time solution of the Navier-Stokes equations and this has been broadly confirmed by the numerical tests which has been performed during this contract. After further tests and studies, this algorithm will soon be available for industrial implementations. GRA

N90-27084# Technische Univ., Berlin (Germany, F.R.). Fachbereich Physikalische Ingenieurwissenschaften.
NUMERICAL INVESTIGATION OF THE INCOMPRESSIBLE PLANE SHEAR LAYER BETWEEN TWO GASES WITH DIFFERENT DENSITIES Ph.D. Thesis [NUMERISCHE UNTERSUCHUNG DER INKOMPRESSIBLEN EBENEN SCHERSCHICHT ZWISCHEN ZWEI GASEN UNTERSCHIEDLICHER DICHTE]
Markus Lummer 1989 155 p In GERMAN Sponsored by DFG
(ETN-90-97315) Avail: NTIS HC A08/MF A01

The plane incompressible shear layer between two gases with different density was investigated using linear inviscid stability analysis and direct (two-dimensional) numerical simulation. Flow fields in the x-direction which are periodically growing in time, or aperiodically growing in space were considered. The stability analysis shows that for periodically growing perturbations the velocity ratio and the density ratio do not affect the flow stability, and that for spatially growing perturbations the instability clearly increases with decreasing velocity ratio. Simulations show that the evolution of periodical flow fields depends strongly on the initial conditions; the spatially growing flow requires an excitation to maintain an unsteady motion. The numerical results agree qualitatively with the results of the stability analysis. The agreement between the calculations and measurements is good for constant density, but only crude for variable density. ESA

N90-27085# Universitaet der Bundeswehr Muenchen, Neubiberg (Germany, F.R.). Inst. fuer Raumfahrttechnik.
RESPONSE OF A SPINNING LIQUID COLUMN TO AXIAL EXCITATION
Helmut Franz Bauer 1988 47 p
(LRT-WE-9-FB-10(1988); ETN-90-97332) Avail: NTIS HC A03/MF A01

The response of a rotating finite liquid column of frictionless liquid, subjected to axial harmonic excitation, is investigated. The response of the free liquid surface elevation and velocity distributuion were determined in the elliptic and hyperbolic frequency range. ESA

N90-27086# Universitaet der Bundeswehr Muenchen, Neubiberg (Germany, F.R.). Inst. fuer Raumfahrttechnik.
RESPONSE OF A LIQUID COLUMN WITH RESPECT TO OSCILLATORY ROTATIONAL TOP- AND BOTTOM EXCITATION
Helmut Franz Bauer 1989 78 p
(LRT-WE-9-FB-8(1989); ETN-90-97339) Avail: NTIS HC A05/MF A01

The response of a cylindrical liquid column of incompressible and nonviscous liquid was investigated for a rotational harmonic excitation of its bottom and top. Free surface displacement and velocity response were determined and evaluated. The transient behavior of the liquid column was treated for a rotational bottom and top excitation. The liquid exhibits singularities at the resonance frequencies. Damping was introduced in a semi-empirical way in the resonance terms. The results are of value for the planning and evaluation of the liquid column resonance experiments to be performed during the second German Spacelab mission D2. ESA

N90-27087# Universitaet der Bundeswehr Muenchen, Neubiberg (Germany, F.R.). Inst. fuer Raumfahrttechnik.
LIQUID SLOSHING RESPONSE IN A SPINNING CONTAINER DUE TO AXIAL EXCITATION
Helmut Franz Bauer 1989 89 p
(LRT-WE-9-FB-9(1989); ETN-90-97340) Avail: NTIS HC A05/MF A01

For a liquid in a spinning container the asymmetric natural frequencies were determined for a free liquid surface and an interfacial surface for an immiscible system. The speed of rotation has to be distinguished between an elliptic frequency range and an hyperbolic range. The liquids are assumed to be of incompressible frictionless medium. The response of the liquids to harmonic axial excitation was determined for the velocity distribution and the free surface or interface displacement. The magnification function of the surface displacement was numerically evaluated for different diameter and density ratios. ESA

N90-27088# Universitaet der Bundeswehr Muenchen, Neubiberg (Germany, F.R.). Inst. fuer Raumfahrttechnik.
OSCILLATORY RESPONSE OF A LIQUID COLUMN TO COUNTER ROTATIONAL EXCITATION
Helmut Franz Bauer 1989 33 p
(LRT-WE-9-FB-12(1989); ETN-90-97343) Avail: NTIS HC A03/MF A01

A finite cylindrical liquid bridge of incompressible and nonviscous liquid is subjected to a harmonic counter-rotational excitation of the top and bottom walls. The response of the free liquid surface and the velocity distribution was determined and numerically evaluated. Since, for frictionless liquids the response exhibits at the resonance singularities, a semi-empirical damping was introduced in the resonance terms. ESA

N90-27089# Universitaet der Bundeswehr Muenchen, Neubiberg (Germany, F.R.). Inst. fuer Raumfahrttechnik.
RESPONSE OF A LIQUID BRIDGE WITH ROTATIONALLY EXCITED BOTTOM
Helmut Franz Bauer 1989 37 p
(LRT-WE-9-FB-13(1989); ETN-90-97344) Avail: NTIS HC A03/MF A01

The response of a cylindrical liquid column of an incompressible and frictionless liquid was investigated for a pitching bridge bottom. The response of the free surface and velocity distribution was determined and numerically evaluated. The transient behavior of the column was considered. Since for non-viscous liquids the response exhibits at the resonance singularities, a semi-empirical damping was introduced in the resonance terms. ESA

N90-27090# Universitaet der Bundeswehr Muenchen, Neubiberg (Germany, F.R.). Inst. fuer Raumfahrttechnik.
RESPONSE OF A VISCOUS LIQUID COLUMN TO VARIOUS PITCH-EXCITATIONS
Helmut Franz Bauer 1989 53 p
(LRT-WE-9-FB-15(1989); ETN-90-97346) Avail: NTIS HC A04/MF A01

The response of a viscous liquid column to counter-directional, one-sided and phase-different pitching excitation of the walls is investigated. The column is placed in zero-gravity environment. The no-slip condition is abandoned. Velocity distribution and free surface displacement is determined as functions of the reduced forcing frequency. Since the upper and lower wall of the liquid change their distance locally, the column liquid always moves into the converging wall space. ESA

N90-27091# Universitaet der Bundeswehr Muenchen, Neubiberg (Germany, F.R.). Inst. fuer Raumfahrttechnik.
RESPONSE OF DIFFERENTLY AXIAL-EXCITED SPINNING LIQUID COLUMNS
Helmut Franz Bauer 1989 48 p
(LRT-WE-9-FB-16(1989); ETN-90-97347) Avail: NTIS HC A03/MF A01

A rotating finite liquid column of frictionless liquid is subjected to various axial excitation modes. The response of the free liquid surface displacement and velocity distribution was determined in the elliptic and hyperbolic range. Differences of the various cases are presented. ESA

N90-27092# Universitaet der Bundeswehr Muenchen, Neubiberg (Germany, F.R.). Inst. fuer Raumfahrttechnik.
NONLINEAR AXISYMMETRIC FREE VIBRATIONS OF A LIQUID IN A CYLINDRICAL TANK WITH AN ELASTIC BOTTOM
Masakatsu Chiba (Iwate Univ., Morioka, Japan) 1989 33 p Sponsored by Ministry of Education, Japan
(LRT-WE-9-FB-17(1989); ETN-90-97348) Avail: NTIS HC A03/MF A01

A theoretical analysis for a nonlinear axisymmetric free vibration of a liquid-cylindrical structure system is presented. The cylindrical tank mounted on a Winkler type foundation, has a rigid wall and an elastic bottom plate. The plate exhibits axisymmetric deformation due to a static liquid pressure and vibrates with large amplitude about the static deflection. The contained liquid has a free surface. The effects of a static deflection due to liquid pressure and a spring constant of the foundation, are considered. ESA

N90-26899# General Electric Co., Schenectady, NY. Corporate Research and Development Center.
FLAME EXTINCTION IN COMPRESSIBLE FLOW Abstract Only
S. M. Correa *In* Sandia National Labs., Summary of Discussions at the Eleventh Meeting of the Sandia Cooperative Group on the Aerothermochemistry of Turbulent Combustion Oct. 1988 p 21 (For primary document see N90-26896 21-25)
Avail: NTIS HC A03/MF A01

N90-26900# Stanford Univ., CA. High Temperature Gasdynamics Lab.
DEVELOPMENT OF PLANAR LASER-INDUCED FLUORESCENCE (PLIF) TECHNIQUES FOR SUPERSONIC FLOWS Abstract Only
Ronald K. Hanson *In* Sandia National Labs., Summary of Discussions at the Eleventh Meeting of the Sandia Cooperative Group on the Aerothermochemistry of Turbulent Combustion Oct. 1988 p 22 (For primary document see N90-26896 21-25)
Avail: NTIS HC A03/MF A01

N90-26901*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.
DIRECT NUMERICAL SIMULATION OF COMPRESSIBLE FREE SHEAR FLOWS Abstract Only
Sanjiva K. Lele *In* Sandia National Labs., Summary of Discussions at the Eleventh Meeting of the Sandia Cooperative Group on the Aerothermochemistry of Turbulent Combustion Oct. 1988 p 23 Previously announced in IAA as A89-25317 (For primary document see N90-26896 21-25)
Avail: NTIS HC A03/MF A01 CSCL 20D

N90-26904# Sandia National Labs., Livermore, CA. Combustion Research Facility.
A LINEAR-EDDY MODEL OF TURBULENT SHEAR LAYER MIXING Abstract Only
Alan R. Kerstein *In its* Summary of Discussions at the Eleventh Meeting of the Sandia Cooperative Group on the Aerothermochemistry of Turbulent Combustion Oct. 1988 p 41 (For primary document see N90-26896 21-25)
Avail: NTIS HC A03/MF A01

35 INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

For aerial photography see *43 Earth Resources and Remote Sensing*. For related information see also *06 Aircraft Instrumentation*, and *19 Spacecraft Instrumentation*.

N90-27093# Aeronautical Research Labs., Melbourne (Australia).
PERSPECTIVE TRANSFORMATION FOR WIDE-VIEW SKY SCENES
L. N. Lester Feb. 1990 14 p
(AD-A222694; ARL-SYS-TM-128; DODA-AR-006-065) Avail: NTIS HC A03/MF A01 CSCL 14/5

Fixed vantage point simulation requires a wide field of view for the external visual environment. The sky scene, however, is of secondary importance as moving objects in the scene are the areas of interest. It is therefore cost-effective to represent the sky in such cases as a two dimensional surface enclosing the earth. This memorandum derives the perspective transformation necessary to project points from this sphere onto two dimensional viewing screens. Inversion of this transformation is also presented. GRA

N90-27094# Rochester Univ., NY. Inst. of Optics.
STRUCTURAL AND OPTICAL PROPERTIES OF DMP-128 HOLOGRAMS DURING ENVIRONMENTAL TESTING
M. Troll and J. Formasa (Polaroid Corp., Cambridge, MA.) 1989 7 p Repr. from Practical Holography 3 (SPIE), v. 1051, 1989
(Contract DAAL03-86-K-0173)
(AD-A221691; ARO-24626.139-PH-UIR) Avail: NTIS HC A02/MF A01 CSCL 14/1

Changes in the structure of photopolymer holograms during environmental testing were studied with two techniques: Scanning electron microscopy of freeze-fracture cross-sections and modeling the refractive index profile. The profile was estimated using optical data: reflectivities corresponding to the fundamental spatial frequency and the second harmonic. Holograms were used that had not been through the normal stabilization treatments for the material, in order to study the properties of the basic structure. The changes are interpreted within the context of the void model for this photopolymer's structure. GRA

N90-27146*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, MD.
EOS VISIBLE IMAGERS
W. L. Barnes *In* NASA, Langley Research Center, Earth Sciences Requirements for the Information Sciences Experiment System Jul. 1990 p 69-81 (For primary document see N90-27140 21-43)
Avail: NTIS HC A10/MF A02 CSCL 14B

N90-27147*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
SAGE 3: A VISIBLE WAVELENGTH LIMB SOUNDER
W. P. Chu, M. P. McCormick, J. Zawodny, and L. R. McMaster *In its* Earth Sciences Requirements for the Information Sciences Experiment System Jul. 1990 p 83-88 (For primary document see N90-27140 21-43)
Avail: NTIS HC A10/MF A02 CSCL 14B

N90-27161*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
APPLICATIONS OF ISES FOR INSTRUMENT SCIENCE
William B. Grant *In its* Earth Sciences Requirements for the Information Sciences Experiment System Jul. 1990 p 213-215 (For primary document see N90-27140 21-43)
Avail: NTIS HC A10/MF A02 CSCL 14B

N90-27181# Finnish Meteorological Inst., Helsinki. Dept. of Geophysics.
COMPARISONS OF THE RECORDING INSTRUMENTS. DESCRIPTION OF THE DIFFERENCE-PLOTS
L. Hakkinen *In its* Proceedings of the International Workshop on Geomagnetic Observatory Data Acquisition and Processing 15 Feb. 1990 p 40-66 (For primary document see N90-27177 21-46)
Avail: NTIS HC A07/MF A01

36 LASERS AND MASERS

Includes parametric amplifiers.

For related information see also *76 Solid-State Physics*.

N90-27095 Department of the Navy, Washington, DC.
FREE ELECTRON LASER INJECTION OSCILLATOR Patent
Avraham Gover, inventor (to Navy), Steven H. Gold, inventor (to Navy), and Victor L. Granatstein, inventor (to Navy) 18 Oct. 1988 12 p Filed 9 Mar. 1989
(AD-D014180; US-Patent-4,779,277; US-Patent-Appl-SN-473411; US-Patent-Class-372-2) Avail: US Patent and Trademark Office CSCL 09/3

This patent discloses a free electron laser for use with a short-pulse relativistic electron source. The device includes a resonant optical cavity in which a spatially-periodic magnetic field is produced by a wiggle magnet assembly. An input optical beam having a wavelength lying within the gate bandwidth of the free electron laser interaction is injected into the cavity. A beam of relativistic electrons produced by a short-pulse source, such as an RF-linac, is injected into the cavity. The electron beam and the input optical beam interact under the influence of the magnetic field to amplify the input optical beam. GRA

N90-27096# Sandia National Labs., Albuquerque, NM.
DEVELOPMENT OF A MULTI-PURPOSE, PULSED-LASER SYSTEM FOR SOLAR CELL PROCESSING APPLICATIONS
D. L. King, B. R. Hansen, and W. M. Lehrer (Edgerton, Germeshausen and Grier, Inc., Wellesley, MA.) 1990 9 p Presented at the 21st Inst. for Electrical and Electronics Engineers Photovoltaic Specialists Conference, Kissimmee, FL, 21-25 May 1990
(Contract DE-AC04-76DP-00789)
(DE90-012181; SAND-89-2479C; CONF-900542-1) Avail: NTIS HC A03

This paper describes the capabilities of a versatile Nd:YAG pulsed laser system developed at Sandia for solar cell processing applications. The results of statistically-based, multi-factor experiments used to characterize the influence of laser-system process variables on patterns produced in silicon wafers and silicon-oxide layers are presented and an initial assessment of laser-grooved solar cell processing conditions is given. DOE

N90-27097# Massachusetts Inst. of Tech., Lexington. Lincoln Lab.
POLAR COORDINATE LASER WRITER FOR BINARY OPTICS FABRICATION
William L. Goltsos and Sharlene Liu Feb. 1990 13 p Repr. from Computer and Optically Formed Holographic Optics (Washington, DC, SPIE), v. 1211, 1990
(Contract F19628-90-C-0002)
(AD-A222827; MS-8737; ESD-TR-90-061) Avail; NTIS HC A03/MF A01 CSCL 09/3

A Laser Writer system for recording centro-symmetric patterns in photoresist has been developed as an alternative method for binary optics mask and component fabrication. This system is capable of generating binary amplitude patterns with linewidths below 1 micron and with a positional accuracy of less than 0.1 micron on up to 3 in. diameter planar substrates. The measured wavefront error and diffraction efficiency of a direct-write two-phase-level F/10 lens confirm that high quality components can be fabricated quickly, easily, and at low cost. GRA

N90-27098# Ortel Corp., Alhambra, CA.
VERTICAL EMITTING, RING GEOMETRY, ULTRA-LOW THRESHOLD, AND ULTRA-HIGH SPEED QUANTUM WELL LASERS FOR OPTICAL INTERCONNECT Report, Mar. - May 1990
Michael Mittelstein and Nadav Bar-Chaim May 1990 9 p
(Contract N00014-88-C-0483; DARPA Order 6325)
(AD-A222932) Avail: NTIS HC A02/MF A01 CSCL 09/3

The main emphasis during this quarter was placed on the following efforts: (1) development of a ridge wave guide as an alternative lateral optical guiding structure; (2) investigation of the ridge wave guide structure in ring configuration; and (3) single quantum well material investigation. GRA

N90-27099# Montana State Univ., Bozeman. Dept. of Physics.
BEAM COMBINING OF EXCIMER LASERS BY STIMULATED RAMAN SCATTERING Final Report, 16 Jul. 1985 - 31 Dec. 1989
John L. Carlsten 31 Dec. 1989 11 p
(Contract N00014-85-K-0477)
(AD-A222973) Avail: NTIS HC A03/MF A01 CSCL 09/3

The primary objective of this research was to determine those factors which would influence the gain in a Raman amplifier that was pumped by a broadband excimer laser. Initial studies concentrated on determining the spatial structure from a Raman generator. The spatial structure was understood in terms of propagation in a quadratic index media. This well-characterized generator output was then injected into a Raman amplifier for gain enhancement studies. This research indicated that a multimode, random phase model for the broadband pump could be used to predict the gain enhancements observed. However, our most recent data indicates that the model fails to account for the transiency found in lower pressure Raman amplifiers. However, further studies will be necessary to resolve this issue. GRA

N90-27100# University of South Florida, Tampa.
DIODE LASER PUMPED SINGLE MODE 1.3 MICRONS Nd:YALO MICROLASER Final Report
Aug. 1989 10 p
(Contract N00014-87-C-2541)
(AD-A223036) Avail: NTIS HC A02/MF A01 CSCL 20/6

The objective of this program was to investigate the implementation of a tunable single frequency Neodymium YALO laser on the 1.34 microns transition capable of producing several milliwatts of output power. This laser is to be used as a seed source to injection lock a larger Nd:YALO laser. The output from the latter is in turn to be frequency tripled and Raman shifted to match the passband of the Cs atomic vapor filter. Such a system may be suitable for use in submarine laser communication applications. GRA

N90-27101# Naval Research Lab., Washington, DC. Atmospheric Physics Branch.
AUREOLE LIDAR: GROUND BASED MEASUREMENT Interim Report
W. P. Hooper 11 May 1990 19 p
(RR031034)
(AD-A223207; NRL-MR-6623) Avail: NTIS HC A03/MF A01 CSCL 17/9

An optical receiver (aureole) with a 50 milliradian field of view is used to measure the light reflected off a topographic target and forward scattered from aerosol particles back to the receiver. Simultaneously, a laser radar (lidar) backscatter profile is recorded. The aureole intensity provides a constraint of the inversion of lidar backscatter onto extinction profiles. A comparison between values of lidar reflection and aureole values is shown for data from 14 days. Atmospheric conditions on these days varied from extremely clear to fog andrain. Using the lidar/aureole relationship, four hundred consecutive lidar profiles are inverted into extinction profiles and displayed in a time-range false color display. This data was taken prior to the passage of a thunderstorm and reveals lidar's ability to observe the optical differences in small scale turbulent eddies. GRA

N90-27102# International Business Machines Corp., San Jose, CA.
INTRACAVITY FREQUENCY DOUBLING OF A Nd:YAG LASER WITH AN ORGANIC NONLINEAR OPTICAL CRYSTAL Interim Report
Stephen Ducharme, W. P. Risk, W. E. Moerner, Victor Y. Lee, R. J. Twieg, and G. C. Bjorklund 13 Mar. 1990 17 p Submitted for publication
(Contract N00014-84-C-0708)
(AD-A222392; IBM-RR-RJ7595; TR-24) Avail: NTIS HC A03/MF A01 CSCL 09/3

Intercavity second harmonic generation of green 532 nm light in a quasi-cw 1064 nm Nd:YAG laser was demonstrated using organic nonlinear optical crystals of DAN (4-(N,N-dimethylamino) 3-acetamidonitrobenzene) immersed in index matching fluid contained in an antireflection coated cuvette. This technique permits crystals to be used directly from solution growth without polishing or antireflection coating them. Up to 0.56 mW peak power of 532 nm light was generated from 2.3 W of intracavity 1064 nm peak power in 100 microsecond pulses. Preliminary results are reported on true cw intracavity harmonic generation with antireflection coated DAN crystals. GRA

N90-27103# Mitre Corp., McLean, VA. JASON Program Office.
A NOTE ON THE STATISTICS OF LASER SPECKLE
Gordon MacDonald Mar. 1990 18 p Sponsored by DARPA, Arlington, VA
(AD-A222408; JSR-87-977A) Avail: NTIS HC A03/MF A01 CSCL 09/3

In considering eye protection, not only the average energy or average power density on the retina must be taken into account but also random variation, as noted by Fried (1981). Random variations can arise in at least two ways. Most surfaces, either natural or manmade, are extremely rough on the scale of an optical wavelength. Under illumination by coherent light, a wave reflected from a typical rough surface consists of contributions from many scattering points or areas. Images formed at a given point are the combination of amplitudes of spread functions, each arising from a different scattering point on the surface. The spread functions add with different phases, giving complex interference patterns, which are labeled speckle. The eyes will form a random intensity pattern on the retina: subjective speckle. In a static, nonturbulent atmosphere, a speckle pattern propagates through the atmosphere unchanged; it is statistically stationary. When turbulence is present, it seems to modulate the brightness of each speckle. Turbulence gives rise to a random, moving patchiness in the atmospheric temperature field and thus in the index of refraction. The combined effect of turbulent eddies to form a screen, which alters the phases of the waves that combined to form speckles. GRA

N90-27104# Coherent Technologies, Inc., Boulder, CO.
A SOLID-STATE MULTIPLE-PASS AMPLIFIER FOR DIODE PUMPED COHERENT LASER RADAR SYSTEMS
Sammy W. Henderson and Charley P. Hale Apr. 1990 68 p
(Contracts N00014-89-C-0220; F33615-88-C-1756)
(AD-A222537; CTI-TR-9005) Avail: NTIS HC A04/MF A01 CSCL 17/9

Requirements for a sensitive, accurate sensor for applications in space-based strategic defense and target recognition point to the need for the development of very robust, agile coherent laser radar instruments. Recent advances in high power pulsed and continuous-wave (CW) laser diode and diode array technology has prompted a renaissance in the use of solid-state laser transmitters in coherent and incoherent laser radar systems. In particular, all-diode-pumped coherent laser radar systems now appear feasible for ground-, air-, and space-based applications where electrical power (efficiency), size, and weight considerations are very important. The unattended lifetime, pulse repetition frequency (PRF), and beam quality of such an all-solid-state laser radar are expected to be improved upon over both CO2 and flashlamp-pumped solid-state systems. In most applications where atmospheric turbulence is not too serve, the performance of the shorter wavelength all-solid-state laser radar systems exceeds that of the longer wavelength CO2 systems. GRA

N90-27105# Massachusetts Inst. of Tech., Cambridge. Dept. of Physics.
STUDY OF SHORT-LIVED UNSTABLE NUCLEI BY MEANS OF LASER OPTICAL PUMPING Ph.D. Thesis
Joseph P. Mackin Jun. 1990 158 p Sponsored by Department of the Army
(AD-A222561) Avail: NTIS HC A08/MF A01 CSCL 20/8

The effectiveness of laser induced nuclear orientation in the study of short lived unstable nuclei using radiation detection was increased by the use of saturation spectroscopy to produce sub-Doppler resolved changes in the anisotropic spatial distribution of the 514 keV gamma rays from the 1 micro sec isomer Rb(85m). The width (HWHM) of these change signals is about 60 MHz, a factor of ten better than Doppler-broadened signals previously obtained. This technique was used to study the D1 and D2 transitions for the isomer. Precise values of the hyperfine A and B coefficients were determined, and used to extract a value for the nuclear magnetic dipole moment (6.043 + or - .005) mu sub N, and, for the first time, a measured value of the nuclear quadrupole moment (- .73 + or - .17)b. Additionally, and a new, more accurate value for the isomer shift (- 113 + or - 5)MHz was determined. GRA

N90-27106# Air Force Weapons Lab., Kirtland AFB, NM.
ONE WAY IMAGING AND AMPLIFICATION THROUGH AN ABERRATOR Final Report, 6 Sep. 1988 - 30 Sep. 1989
P. A. Laferriere, C. J. Wetterer, and D. R. Martinez Mar. 1990 16 p
(AD-A221640; WL-TR-89-84) Avail: NTIS HC A03/MF A01 CSCL 09/3

The results are presented of an experiment combining one-way image reconstruction using four wave mixing in carbon disulfide with optical parametric amplification in lithium iodate. A mode locked Nd:YAG laser was used as the light source, and a resolution target provided the image. The distortions caused by a severe static aberrator were corrected, but only when the four wave mixing process was confined to a short interaction length and strict alignment conditions were satisfied. The optical parametric amplifier was then used to amplify the distortion-corrected image. GRA

N90-27107# Naval Research Lab., Washington, DC. Radiation Hydrodynamics Branch.
X RAY LASER PROGRAM REPORT FOR FY 1989 Final Report, 1 Oct. 1988 - 30 Sep. 1989
24 May 1990 87 p
(AD-A221818; NRL-MR-6622) Avail: NTIS HC A05/MF A01 CSCL 09/3

This report details the progress achieved by the Radiation Hydrodynamics and Pulsed Power Physics Branches in X Ray Laser experiments and modeling during FY 1989. Significant experimental accomplishments in photopumping of neon by both neon and sodium to produce inversions via either the Auger effect or resonant photopumping are described in the first section. Subsequent sections present in detail modeling of neon-neon photopumping, recombination lasers and development of a new diagnostic for neonlike x ray laser plasmas. GRA

37 MECHANICAL ENGINEERING

Includes auxiliary systems (nonpower); machine elements and processes; and mechanical equipment.

N90-27108*# California Inst. of Tech., Pasadena. Div. of Engineering and Applied Science.
EXPERIMENTAL INVESTIGATION OF THE HYDRODYNAMIC FORCES ON THE SHROUD OF A CENTRIFUGAL PUMP IMPELLER Thesis
Fei Zhuang 1989 83 p
(Contract NAS8-33108; NAG8-118)
(NASA-CR-186952; NAS 1.26:186952; E249.9) Avail: NTIS HC A05/MF A01 CSCL 13I

Fluid-induced forces acting on a rotating impeller are known to cause rotor-dynamic problems in turbomachines. The forces generated by leakage flow along the front shroud surface of a centrifugal turbomachine impeller play an important role among these fluid-induced forces. The present research was aimed to gain a better understanding of these shroud forces. An experimental apparatus was designed and constructed to simulate the impeller shroud leakage flow. Hydrodynamic forces and steady and unsteady pressure distributions on the rotating shroud were measured as functions of eccentricity, width of shroud clearance, face seal clearance and shaft rotating speed. The forces measured from the dynamometer and manometers agreed well. The hydrodynamic force matrices were found skew-symmetric and statically unstable. This is qualitatively similar to the result of previous hydrodynamic volute force measurements. Nondimensionalized normal and tangential forces decrease slightly as Reynolds number increases. As the width of the shroud clearance decreases and/or the eccentricity increases, the hydrodynamic forces increase nonlinearly. There was some evidence found that increased front seal clearance could reduce

the radial shroud forces and the relative magnitude of the destabilizing tangential force. Subharmonic pressure fluctuations were also observed which may adversely affect the behavior of the rotor system. Author

N90-27109# National Inst. of Standards and Technology, Gaithersburg, MD. Robot Systems Div.
ELECTRONICS DESIGN OF THE INFRARED/ULTRASONIC SENSING FOR A ROBOT GRIPPER
Roger Bostelman Nov. 1989 29 p
(PB90-160383; NISTIR-89/4223) Avail: NTIS HC A03/MF A01
CSCL 13I

An overview is presented of the electronics design of the Infrared/Ultrasonic Sensing Robot Gripper (Instrumented Gripper) designed, built and tested at the National Institute of Standards and Technology (NIST) in Gaithersburg, Maryland. The gripper is for use in the Automated Manufacturing Research Facilities (AMRF) Cleaning and Deburring Workstation (CDWS) at the National Institute of Standards and Technology. A System Description is presented followed by the design of the sensor circuitry and the power. The sensor circuitry includes the sensor interface (to the sensor and the system) through the rectification and/or interpretation circuitry and finally to the output circuitry. The experiments performed are explained and their results are given in detail. Future considerations for the system follow and some applications for the Instrumented Gripper and further sensing ideas are discussed. Author

N90-27110*# National Aeronautics and Space Administration. Pasadena Office, CA.
METHOD AND APPARATUS FOR CONFIGURATION CONTROL OF REDUNDANT ROBOTS Patent Application
Homayoun Seraji, inventor (to NASA) (Jet Propulsion Lab., California Inst. of Tech., Pasadena.) 28 Dec. 1989 85 p
(Contract NAS7-918)
(NASA-Case-NPO-17801-1-CU; NAS 1.71:NPO-17801-1-CU; US-Patent-Appl-SN-459029) Avail: NTIS HC A05/MF A01
CSCL 13I

A method and apparatus to control a robot or manipulator configuration over the entire motion based on augmentation of the manipulator forward kinematics is disclosed. A set of kinematic functions is defined in Cartesian or joint space to reflect the desirable configuration that will be achieved in addition to the specified end-effector motion. The user-defined kinematic functions and the end-effector Cartesian coordinates are combined to form a set of task-related configuration variables as generalized coordinates for the manipulator. A task-based adaptive scheme is then utilized to directly control the configuration variables so as to achieve tracking of some desired reference trajectories throughout the robot motion. This accomplishes the basic task of desired end-effector motion, while utilizing the redundancy to achieve any additional task through the desired time variation of the kinematic functions. The present invention can also be used for optimization of any kinematic objective function, or for satisfaction of a set of kinematic inequality constraints, as in an obstacle avoidance problem. In contrast to pseudoinverse-based methods, the configuration control scheme ensures cyclic motion of the manipulator, which is an essential requirement for repetitive operations. The control law is simple and computationally very fast, and does not require either the complex manipulator dynamic model or the complicated inverse kinematic transformation. The configuration control scheme can alternatively be implemented in joint space. NASA

N90-27111*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.
QUICK CONNECT COUPLING Patent Application
Benny B. Sprague, inventor (to NASA) 30 Mar. 1990 11 p
(NASA-Case-MSC-21539-1; NAS 1.71:MSC-21539-1; US-Patent-Appl-SN-503410) Avail: NTIS HC A03/MF A01
CSCL 13K

A coupling device has a transversely arranged, open-end groove in a flange attached to a pipe end. The groove in the flange receives a circumferentially arranged locking flange element on the other coupling member and permits alignment of the bores of the coupling members when the locking flange element is in the open end groove. Upon alignment of the bores of the coupling members, a trigger member is activated to automatically release a spring biased tubular member in one of the coupling members. The tubular member has a conical end which is displaced into the other coupling member to lock the coupling members to one another. A tensioning nut is threadedly movable on a coupling member so as to be moved into tightening engagement with the other coupling member. NASA

N90-27112*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, AL.
CRYOGENIC ANTI-FRICTION BEARING WITH INNER RACE Patent Application
Dale H. Blount, inventor (to NASA) 31 Jan. 1990 16 p
(NASA-Case-MFS-28384-1; NAS 1.71:MFS-28384-1; US-Patent-Appl-SN-473064) Avail: NTIS HC A03/MF A01
CSCL 13K

This invention consists of a bearing designed to operate in a cryogenic environment and which has an inner raceway generally constructed as an annular band fitted by an interference fit to a rotating shaft. A pair of annular tension bands are fitted onto opposed sides of the band and function to firmly clamp the raceway to the shaft. This occurs because the tension bands are constructed of a material which, when cooled to approximately -335 F shrinks more than the raceway and the shaft to which it is fitted. The bands further relax somewhat at room temperature and permit the interference fit between the raceway and the shaft to be sized such that the raceway is not overly stressed. NASA

N90-27113*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, AL.
SAMPLE HOLDER SUPPORT FOR MICROSCOPES Patent Application
Anthony Berry, inventor (to NASA) and Billy H. Nerren, inventor (to NASA) 15 May 1990 11 p
(NASA-Case-MFS-28420-1; NAS 1.71:MFS-28420-1; US-Patent-Appl-SN-523675) Avail: NTIS HC A03/MF A01
CSCL 13I

A sample filter holder is disclosed for use with a microscope for holding the filter in a planar condition on the stage of the microscope so that automatic focusing of the microscope can be performed on particle samples dispersed on the filter. The holder includes a base having a well communicating with an inlet port which is connected to a suction pump. A screen assembly is positioned within the well. The screen assembly includes a disk having a screen positioned on its top surface and secured to the disk at the peripheral edge of the screen. Small bores communicate the outer surface of the screen with the well. The filter is placed on the screen and is held in a flat disposition by the suction forces. NASA

N90-27114*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
BRAIDED COMPOSITE FASTENERS AND METHOD FOR PRODUCING SAME Patent Application
James Wayne Sawyer, inventor (to NASA) 18 Oct. 1989 14 p
(NASA-Case-LAR-14062-1; NAS 1.71:LAR-14062-1; US-Patent-Appl-SN-423089) Avail: NTIS HC A03/MF A01
CSCL 13K

The invention is a high-temperature resistant fastener made of composite material and a method for producing such a fastener. A braiding process is used to produce a preform, which is then molded. The molding process and the unique characteristics of braided preforms allow one of a variety of differently shaped fastening means such as threads to be molded as an integral part of the finished fastener. NASA

N90-27115*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
METHOD AND APPARATUS FOR APPLYING A MECHANICAL FORCE TO SURFACE Patent Application
Frank H. Supplee, Jr., inventor (to NASA) and Ping Tcheng, inventor (to NASA) 27 Nov. 1989 17 p
(NASA-Case-LAR-14009-1; NAS 1.71:LAR-14009-1; US-Patent-Appl-SN-441671) Avail: NTIS HC A03/MF A01 CSCL 13I

The invention is a method of and apparatus for applying a mechanical force to a nerve surface by means of a displaceable probe assembly. The probe assembly is affixed to a force transducer selectively movable by means of an actuator that includes the steps of positioning the probe assembly on the nerve surface by moving the movable actuator and force transducer to a first calibrated position to apply a first determined level of mechanical force to the nerve surface, moving the actuator and the probe assembly relative to the nerve surface while continuously measuring the force actually applied to the nerve surface irrespective of the resulting movement of the nerve surface. NASA

N90-27116*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
SUSPENSION MECHANISM AND METHOD Patent Application
Stanley E. Woodard, inventor (to NASA) and Victor M. Cooley, inventor (to NASA) 31 Jan. 1990 10 p
(NASA-Case-LAR-14142-1; NAS 1.71:LAR-14142-1; US-Patent-Appl-SN-473030) Avail: NTIS HC A02/MF A01 CSCL 13I

The invention is a suspension mechanism and method for suspending a flexible test structure T(sub s) subjected to large horizontal translational and vibratory motions. A zero-spring rate mechanism between air cushions A-1 and A-2 established by air bearings support an end of the test structure T(sub s) on a flat surface of a table permitting up to six degrees of freedom of motion of the suspended test structure T(sub s) substantially unconstrained by the suspension mechanism. NASA

N90-27117# Georgia Inst. of Tech., Atlanta. School of Physics.
MICROSCOPIC MODELING OF TRIBOLOGICAL PHENOMENA Final Technical Report, 1 Jan. - 31 Dec. 1989
Uzi Landman and M. W. Ribarsky 28 Feb. 1990 92 p
(Grant AF-AFOSR-0230-89)
(AD-A222049; AFOSR-90-0578TR) Avail: NTIS HC A05/MF A01 CSCL 20/11

Computer-based large-scale molecule dynamics simulations are developed, implemented and used to investigate the energetics and dynamical mechanisms in materials under stress and interfacial processes occuring between material tips and substrate surfaces. Studies of the consequences of intermetallic interactions between a nickle tip and a golf surface reveal microscopic information about processes of adhesion, contact formation, nanoindentation, connective neck formation, plastic deformation and fracture. The theoretical predictions correlate well with Atomic force microscopy experiments. Novel tribological phenomena coupled to enhanced surface superionic conductivity in (Cadmium Fluoride) are investigated. GRA

N90-27118# Universal Energy Systems, Inc., Dayton, OH.
SELF-LUBRICATING SURFACES BY ION BEAM PROCESSING Final Report, 11 Aug. 1989 - 16 Mar. 1990
Rabi S. Bhattacharya Jun. 1990 34 p
(Contract F33615-89-C-2944; AF Proj. 3005)
(AD-A222489; WRDC-TR-90-2044) Avail: NTIS HC A03/MF A01 CSCL 20/7

The primary research objective of this work was to develop self-lubricating surface and coatings through direct ion implantations and a combined process of electron beam evaporation and ion implantation. The latter is most commonly referred in the literature as ion beam assisted deposition (IBAD). IBAD of a bi-layer coating of Calcium Fluoride/Silver on Silicon nitride resulted in a very adherent coating that exhibited significantly low friction and wear characteristic at both room and elevated temperatures (800 C). Ion beam assisted titanium dioxide coating on M50 steel showed significantly improved friction and wear characteristics at room temperature. Ion beam assisted Cadmium Oxide coating lowered the friction coefficient of M50 steel 400 C. The ion beam assisted deposition technique for fabricating self-lubricating surfaces appears to have good technical feasibility for defense and industrial applications, owing to the overall simplicity and scalability of the technique. The initial applications are likely to be in the seals and bearings of engines, variable stator vanes, etc., in gas turbine engine technology. GRA

N90-27119# Carnegie-Mellon Univ., Pittsburgh, PA. Robotics Inst.
DEVELOPMENT OF AN INTEGRATED MOBILE ROBOT SYSTEM AT CARNEGIE-MELLON UNIVERSITY Final Report, 1 Jul. 1988 - 31 Dec. 1989
Steve Shafer and William Whittaker May 1990 109 p
(Contract DACA76-86-C-0019; DARPA Order 5682)
(AD-A222494; CMU-RI-TR-90-12; ETL-0565) Avail: NTIS HC A06/MF A01 CSCL 12/9

This report describes progress in development of an integrated mobile robot system at the Robotics Institute at Carnegie Mellon University from July 1988 to December 1989. This research was sponsored by the Defense Advanced Research Projects Agency and monitored by the U.S. Army Engineer Topographic Laboratories under contract DACA76-86-C-0019. In this program, we pursued a broad agenda of research in the development of mobile robot vehicles, focused on the NAVLAB computer-controlled van. In the period covered by this report, July 1988 to December 1989, we addressed major software issues for mobile robot vehicles: Evolution of the CODGER Blackboard and the Driving Pipeline Architecture; and Kinematic Path Planning for Wheeled Vehicles. This software is central to the New Generation System (NGS) for robot vision and navigation, which combines many independent technologies to produce an integrated mobile robot system. GRA

N90-27332*# West Virginia Univ., Morgantown. Artificial Intelligence Lab.
THE SIXTH GENERATION ROBOT IN SPACE
A. Butcher, A. Das, Y. V. Reddy, and H. Singh *In* NASA, Marshall Space Flight Center, Fifth Conference on Artificial Intelligence for Space Applications May 1990 p 545-550 (For primary document see N90-27275 21-61)
(Contract DASG60-86-0094)
Avail: NTIS HC A25/MF A04 CSCL 13I

38 QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

N90-27120# Aeritalia S.p.A., Turin (Italy). Unita Efficacia del Sistema.
ESTIMATION OF DEFECTIVE RATE OF MECHANIC-HYDRAULIC COMPONENTS [STIMA DEL TASSO DI GUASTO PER COMPONENTI MECCANICO-IDRAULICI]
R. Buffardi and S. Chiesa (Politecnico di Torino, Italy) 1988 8 p In ITALIAN; ENGLISH summary
(Contract CNR-88-03287-07)
(ETN-90-97275) Avail: NTIS HC A02/MF A01

The contributions made to an aircraft reliability and safety strategic programs are described. The defect rate of mechanical and hydraulical components is obtained as a function of the quality level and environmental conditions. The proposed analysis is confirmed by experimental data. The applications to aircraft design are discussed. ESA

39 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance.*

N90-27121*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
MODAL INTERACTION IN POSTBUCKLED PLATES. THEORY
Gaylen A. Thurston Washington Nov. 1989 21 p
(NASA-TP-2943; L-16573; NAS 1.60:2943) Avail: NTIS HC A03/MF A01 CSCL 20K

Plates can have more than one buckled solution for a fixed set of boundary conditions. The theory for the identification and the computation of multiple solutions in buckled plates is examined. The theory predicts modal interaction (which is also called change in buckle pattern or secondary buckling) in experiments on certain plates with multiple theoretical solutions. A set of coordinate functions is defined for Galerkin's method so that the von Karman plate equations are reduced to a coupled set of cubic equations in generalized coordinates that are uncoupled in the linear terms. An iterative procedure for solving modal interaction problems is suggested based on this cubic form. Author

N90-27122*# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Engineering Science and Mechanics.
STATIC AND FREE-VIBRATIONAL RESPONSE OF SEMI-CIRCULAR GRAPHITE-EPOXY FRAMES WITH THIN-WALLED OPEN SECTIONS Final Report
J. Scott Collins and Eric R. Johnson Washington NASA Mar. 1990 216 p
(Grant NAG1-343)
(NASA-CR-4287; NAS 1.26:4287; VPI-E-89-19) Avail: NTIS HC A10/MF A02 CSCL 20K

Experiments were conducted to measure the 3-D static and free vibrational response of two graphite-epoxy, thin walled, open section frames. The frames are semi-circular with a radius of three feet, and one specimen has an I cross section and the other has a channel cross section. The flexibility influence coefficients were measured in static tests for loads applied at midspan with the ends of the specimens clamped. Natural frequencies and modes were determined from vibrational tests for free and clamped end conditions. The experimental data is used to evaluate a new finite element which was developed specifically for the analysis of curved, thin walled structures. The formulation of the element is based on a Vlasov-type, thin walled, curved beam theory. Author

N90-27123# Harvard Univ., Cambridge, MA. Div. of Applied Sciences.
ENGINEERING FRACTURE MECHANICS Final Report, 5 Jun. 1984 - 30 Sep. 1989
Bernard Budiansky 30 Sep. 1989 5 p
(Contract N00014-84-K-0510)
(AD-A222699) Avail: NTIS HC A01/MF A01 CSCL 20/11

On the basis of the Dugdale model, approximate weight-function procedures for crack analysis, a crack-opening shape criterion for continuing crack growth, and theoretical curves for tearing resistance were derived for thin flat sheets of finite size. The substantial effects of finite specimen size and initial tearing resistance were thereby revealed. This work was extended to circumferential cracks in cylindrical shells subjected to bending for which crack growth resistance curves. The singular fields around the tips of growing cracks in linear-hardening materials were calculated for a variety of conditions. The actual magnitude of the singularity strength was also calculated, for steady crack growth, as a function of the applied stress-intensity factor and strain-hardening of the material. GRA

N90-27124# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Engineering Science and Mechanics.
THE EFFECT OF NONLINEARITIES ON FLEXIBLE STRUCTURES Final Report, Jan. 1986 - Sep. 1989
Ali H. Nayfeh and Dean T. Mook 19 Feb. 1990 58 p
(Grant AF-AFOSR-0090-86; AF Proj. 2302)
(AD-A222705; AFOSR-90-0572TR) Avail: NTIS HC A04/MF A01 CSCL 20/11

The project is a theoretical and experimental investigation into the influence of nonlinearities on flexible structures in the presence of multifrequency parametric and external excitations having independent frequencies and phases and arbitrary amplitudes. The nonlinearities and excitations may appear in the governing equations, or the boundary conditions, or both. The study focused on resonance conditions that produce large and possibly damaging motions. Special attention was given to modal coupling and exchanges of energy. The important resonances and their interactions are classified and experiments devised illustrating the phenomena. GRA

N90-27125# David Taylor Research Center, Bethesda, MD. Dept. of Ship Materials Engineering.
A FRAMEWORK TO CORRELATE a/W RATIO EFFECTS ON ELASTIC-PLASTIC FRACTURE TOUGHNESS (J (SUB c)) Research and Development Report, Feb. 1989 - Feb. 1990
R. H. Dodds, Jr., T. L. Anderson, and M. T. Kirk Feb. 1990 44 p
(AD-A222822; DTRC/SME-90/05) Avail: NTIS HC A03/MF A01 CSCL 20/11

Single edge notched bend (SENB) specimens containing shallow cracks (a/W less than 0.2) are commonly employed for fracture testing of ferritic material in the lower-transition region where extensive plasticity (but no significant ductile crack growth) precedes unstable fracture. Critical J-values (Jc) for shallow crack specimens are significantly larger (factor of 2 to 3) than the Jc-values for corresponding deep crack specimens at identical temperatures. The increase of fracture toughness arises from the loss of constraint that occurs when the gross plastic zones of bending impinge on the otherwise autonomous crack tip plastic zones. Consequently, SENB specimens with small and large a/W (crack length/specimen width) ratios loaded to the same J-value have markedly different crack tip stresses under large scale plasticity. Detailed, plane strain element analyses and a local stress based criterion for cleavage fracture are combined to establish specimen size requirements (deformation limits) for testing in the transition region which assure a single parameter (J) characterization of the crack tip stress field. Moreover, these analyses provide the first quantitative framework to correlate Jc-values with a/W ratio once the deformation limits are exceeded. GRA

N90-27126# Air Force Inst. of Tech., Wright-Patterson AFB, OH. School of Engineering.
DYNAMIC STRUCTURAL ANALYSIS USING BOUNDARY ELEMENT TECHNIQUES M.S. Thesis
Matthew C. Phillips Jun. 1990 74 p
(AD-A222943; AFIT/GAE/ENY/89D-28) Avail: NTIS HC A04/MF A01 CSCL 20/14

The purpose of this thesis is to demonstrate the use of boundary element techniques for the dynamic analyses of geometrically repetitive structures using the traveling wave approach. A formulation of the boundary element method (BEM) for 2-D isotropic materials is developed. The BEM formulation is then used to calculate the mass and stiffness matrices of one bay of a baseline structure. From the mass and stiffness a transfer matrix is developed for the bay. Using traveling wave theory, the transfer matrix is then used to identify the dynamical characteristics of a multiple bay structure. Results are compared to continuum theory. GRA

N90-27127# Naval Research Lab., Washington, DC. Mechanics of Materials Branch.
COMPUTATIONAL INVESTIGATION OF LOCAL MATERIAL STRENGTH AND TOUGHNESS ON CRACK GROWTH
V. G. DeGiorgi and P. Matic 14 May 1990 51 p
(AD-A223189; NRL-MR-6591) Avail: NTIS HC A04/MF A01 CSCL 20/11

Computational simulation of stable crack growth is an important aspect of structural integrity prediction. Modern alloy strength and ductility increase local material fracture toughness but simultaneously complicate stable crack growth predictions. Material modeling, material parameter identification, fracture criterion and numerical crack growth algorithms are issues which must be addressed for robust stable crack growth prediction. In this investigation, a series of finite element simulations were undertaken to investigate two-dimensional Mode 1 crack growth in a modified compact tension specimen geometry. Two different crack lengths were considered. HY-100 steel parameters, previously characterized for large strain deformation, were utilized. Additional material responses, based on the HY-100 nonlinear response but with different yield strengths and ductilities, were also considered to parametrically assess material effects on crack growth. GRA

N90-27128# Northwestern Univ., Evanston, IL. Dept. of Civil Engineering.
MICROMECHANICS OF SIZE EFFECT IN FAILURE DUE TO DISTRIBUTED CRACKING Final Report, 1 Jan. 1987 - 31 Dec. 1989
Zdenek P. Bazant and Ted Belytyschko 26 Feb. 1990 540 p
(Contract F49620-87-C-0030; AF Proj. 2302)
(AD-A223211; NU-90-2/498-AR1; AFOSR-90-0503TR) Avail: NTIS HC A23/MF A03 CSCL 20/11

An extensive study of the micromechanics aspects and size effects associated with strain softening damage due to distributed cracking in brittle heterogeneous materials such as concrete, rocks and ceramics has been carried out and presented in a sequence of publications. The results may be grouped in five categories: (1) Size Effects, (2) Micromechanics Aspects, (3) Nonlocal Continuum Models, (4) Localization Instabilities, (5) Thermodynamic Analysis of Stable Path, and (6) Numerical Implementation of Localization Limiters. The law governing the size effect due to localization of strain softening into a finite size fracture process zone has been formulated, experimentally verified and calibrated. Knowledge of the size effect law has led to a method of determining nonlinear fracture properties on the basis of maximum loads of geometrically similar specimens of different sizes. The concept of a brittleness number characterizing the proximity of response of any structure to linear elastic fracture mechanics has been developed. Extensive experiments have been conducted on concrete, rock and ceramics. GRA

N90-27129# Cornell Univ., Ithaca, NY. Center for Applied Mathematics.
SYMMETRY AND GLOBAL BIFURCATION IN NONLINEAR SOLID MECHANICS Final Report, 1 Oct. 1988 - 1 Jan. 1990
Timothy J. Healey 27 Apr. 1990 16 p
(Grant AF-AFOSR-0222-88; AF Proj. 2304)
(AD-A221981; AFOSR-90-0549TR) Avail: NTIS HC A03/MF A01 CSCL 20/11

Symmetry methods and group-theoretic ideas are combined with tools from nonlinear analysis to solve finite deformation problems of nonlinear elastomechanics. A key feature of the work is the ability to perform detailed global bifurcation analyses of differential equations with symmetries. GRA

N90-27130# United Technologies Research Center, East Hartford, CT.
FRACTURE MECHANICS ANALYSIS FOR SHORT CRACKS Final Technical Report, 1 Aug. 1986 - 31 Dec. 1990
B. S. Annigeri 27 Feb. 1990 41 p
(Contract F49620-86-C-0095; AF Proj. 2302)
(AD-A222170; UTRC/R90-957565-F; AFOSR-90-0545TR) Avail: NTIS HC A03/MF A01 CSCL 20/11

This report pertains to the development of the Surface Integral and Finite Element (SAFE) hybrid method for the analysis of short or physically small cracks. The development of yield strip models for modeling crack tip plasticity is presented. The effects of loading and unloading are investigated with regard to plastic zone size and residual deformation. Calculations for the opening loads are presented for long and short cracks and the difference in fatigue crack growth behavior is determined and correlated to the effective stress intensity factor range. GRA

N90-27131# Naval Postgraduate School, Monterey, CA. Dept. of Mechanical Engineering.
THE RESPONSE AND FAILURE MECHANISMS OF CIRCULAR METAL AND COMPOSITE PLATES SUBJECTED TO UNDERWATER SHOCK LOADING Progress Report, 1 Oct. 1988 - 30 Sep. 1989
Robert A. Jones and Young S. Shin Feb. 1990 223 p
(Contract MIPR-89-568)
(AD-A222200; NPS69-90-02) Avail: NTIS HC A10/MF A02 CSCL 20/11

The response and failure mechanism of circular aluminum and S-2 glass fiber/polyester resin matrix composite panels response to underwater shock of loading were investigated. The response of the aluminum panels was compared to the characteristic response of thin circular metal plates subjected to shock loading with a good degree of correlation. The response of the aluminum panels was used a reference with which to compare the response of the composite panels. The response and failure mechanism of the composite panels were found to be highly dependent on the boundary conditions of the panel. For the conditions of this test series, in which the panel boundary was allowed limited motion in the radial direction, the response of the composite panel was determined to be generally similar to the response of the aluminum panels, mitigated by the high strength in tension of the glass fiber. The failure mechanism appeared to be localized matrix failure in compression due to the high circumferential stresses generated as the panel was transversely deflected by the shock wave. GRA

N90-27132# Akron Univ., OH. Inst. of Polymer Engineering.
STRENGTH UNDER VARIOUS MODES OF DEFORMATION
C. W. Extrand and A. N. Gent May 1990 52 p Submitted for publication
(Contract N00014-85-K-0222)
(AD-A222412; TR-24) Avail: NTIS HC A04/MF A01 CSCL 07/6

Breaking stresses and strains were measured for sheets of a brittle elastic material, a highly crosslinked polyisoprene rubber, under three different modes of deformation: simple tension, pure shear, and equi-biaxial extension. Sharp cracks, about 2 millimeters long, were made in the center of each specimen before testing. The breaking stress for equi-biaxial straining was found to be significantly higher than for uniaxial straining while the breaking strain was about one-half as large. All of the results are in accord with a single value of the fracture energy, about 150 Joules/sq m. GRA

N90-27133# Florida Atlantic Univ., Boca Raton.
STOCHASTIC STRUCTURAL DYNAMICS FOR AEROSPACE APPLICATIONS Final Report, 1 Nov. 1987 - 30 Dec. 1989
Y. K. Lin 15 Mar. 1990 72 p
(Grant AF-AFOSR-0005-88; AF Proj. 2302)
(AD-A221517; AFOSR-90-0446TR) Avail: NTIS HC A04/MF A01 CSCL 22/1

Three technical areas are addressed: (1) A new general theory is developed to predict the response of a truss-type space structure under arbitrary loading using the concept of wave propagation and scattering in piece-wise periodic structures. (2) The effects of random imperfection (or disorder) are taken into account based on an assumed spatial ergodicity property of the imperfect periodic truss units. The random disorder has the tendency to inhibit wave propagation, quantified by a localization factor. A scheme is devised to permit successive improvement of accuracy in the computation of localization factor, making it applicable to all practical cases regardless of the relative measures between disorder and the internal coupling. (3) New exact and approximate solution techniques are developed for nonlinear dynamical systems under random excitation. The exact solution technique is based on separation of probability flow into the potential flow and the

circulatory flow. Approximate solution is obtained under a statistical criterion that the average dissipation energy remains the same for the original system and a substituting system which is exactly solvable. GRA

N90-27134# Army Armament Research, Development and Engineering Center, Watervliet, NY.
LOAD-POINT COMPLIANCE FOR THE ARC BEND-ARC SUPPORT FRACTURE TOUGHNESS SPECIMEN Final Report
Francis I. Baratta, Joseph A. Kapp, and David S. Saunders (Aeronautical Research Labs., Melbourne, Australia) Mar. 1990 42 p Presented at the 21st National Fracture Mechanics Symposium, Annapolis, MD, Jun. 1988 Submitted for publication
(AD-A221618; ARCCB-TR-90011) Avail: NTIS HC A03/MF A01 CSCL 20/11

The primary objective of this work is to provide the theoretical computation of load-point compliance for the arc bend-arc support specimen and some experimental verification of these predictions. This specimen is a segment of an annular disk loaded in three-point bending with the roller supports positioned at the inside surface. Load-line compliance was determined principally by utilizing Irwin's Equation that relates the compliance rate of change with crack length to the strain energy release rate. The strain energy release rate was determined from the stress intensity solution available in the literature for this sample. Corroboration was also provided by utilizing boundary collocation (BC), boundary integral element (BIE), and finite element methods (FEM). Representative cases were experimentally tested to confirm theoretical and numerical results. During those tests, it was also found that duplication of idealized support and fixture conditions were extremely important with regard to accurate measurement of load-point compliance. GRA

N90-27135# George Washington Univ., Hampton, VA. Joint Inst. for Advancement of Flight Sciences.
IMPROVED COMPUTATIONAL STRATEGY FOR PREDICTING THE RESPONSE OF COMPLEX SYSTEMS Final Report, 1 Jan. 1987 - 31 Dec. 1989
Ahmed K. Noor 29 Mar. 1990 32 p
(Grant AF-AFOSR-0115-87; AF Proj. 2302)
(AD-A221661; AFOSR-90-0452TR) Avail: NTIS HC A03/MF A01 CSCL 13/13

An effective computational strategy was developed for the analysis of large and complex structures. The strategy is based on generating the response of the complex structures using large perturbations from that of a lower-order (simpler) model associated with a simpler structure (or a simpler mathematical/discrete model of the original structure). The three key elements of the strategy are: (1) mixed (or primitive variable) formulation with the fundamental unknowns consisting of generalized displacements and stress parameters; (2) operator splitting, or a reduction method to relate the arrays and degrees of freedom of the original complex structure to those of the simpler system; and (3) efficient iterative process for the generation of the response of the complex structure starting from that of the simpler system. The strategy has been successfully applied to a number of linear and nonlinear stress analysis problems, free vibration and nonlinear structural dynamics problems. The strategy was also used to obtain accurate transverse stresses in laminated composite plates and shells, using the 2-D first-order shell (plate) theory as the simpler model. GRA

N90-27136# Pennsylvania State Univ., University Park. Dept. of Materials Science and Engineering.
ON MODELING THE EFFECT OF PORE SHAPES ON DUCTILE FRACTURE
A. B. Geltmacher and D. A. Koss May 1990 9 p
(Contract N00014-86-K-0381)
(AD-A221774; TR-14) Avail: NTIS HC A02/MF A01 CSCL 20/11

An initial effort has been made to simulate the effect of pore shape on the ductibility of porous metals. The simulation is performed utilizing a computer model in which distributions of pores are modeled in two dimensions by pseudo-random arrays of either circular or elongated holes. As expected, the simulations predict that tensile ductility decreases as the area fraction of holes increase and that specimens containing elongated holes are less ductile. However, somewhat unexpected is the prediction that the hole/pore shape effect becomes more pronounced with increasing area fraction of holes/pores. The results can be readily understood in terms of the local strain distributions near holes, the dependence of inter-hole spacings on the area fraction of holes, and strain-based hole-linking criteria. GRA

N90-26819# PhotoStrain, Dallas, TX.
PHOTOELASTICITY: A COST EFFECTIVE DESIGN TOOL
Jan Cernosek *In* AFWAL, Proceedings of the 1987 Aircraft/Engine Structural Integrity Program (ASIP/ENSIP) Conference Jun. 1988 p 640-646 (For primary document see N90-26807 21-05)
Avail: NTIS HC A99/MF E06 CSCL 20C

N90-27323*# Rockwell International Corp., Canoga Park, CA. Rocketdyne Div.
THE COMPOSITE LOAD SPECTRA PROJECT
J. F. Newell, H. Ho, and R. E. Kurth (Battelle Columbus Labs., OH.) *In* NASA, Marshall Space Flight Center, Fifth Conference on Artificial Intelligence for Space Applications May 1990 p 457-466 (For primary document see N90-27275 21-61)
Avail: NTIS HC A25/MF A04 CSCL 20K

42 GEOSCIENCES (GENERAL)

No abstracts in this category.

43 EARTH RESOURCES AND REMOTE SENSING

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.

For instrumentation see *35 Instrumentation and Photography.*

N90-27137 Colorado Univ., Boulder.
THE GLOBAL POSITIONING SYSTEM: A NEW TOOL FOR TECTONIC STUDIES Ph.D. Thesis
Christian Rocken 1988 281 p
Avail: Univ. Microfilms Order No. DA8912218

Satellite geodesy, using the Global Positioning System (GPS) has been used to determine the vector between two points on the earth with an accuracy of up to 1 part in 10(exp 8). This corresponds to a length-error of 1 mm for a 100 km baseline. By comparison of ray-tracing results through radiosonde-profiles it is confirmed that surface based models can accurately predict the dry tropospheric delay. One method uses the technology of water-vapor-radiometry to measure the path delay due to the wet atmosphere. In two experiments the WVR correction has a strong effect on the baseline vector. Since the true baseline vector is not known, a reduction of the day-to-day scatter of the baseline vector is the only indication that the WVR corrections improve the results, rather than just change them. The offset in the baseline vector and the reduction in the scatter are strong indications that WVRs are needed for troposphere corrections in high-accuracy GPS. An alternative to measuring the wet path delay is to estimate it from the GPS phase residuals. This method was developed and used successfully in synthetic data tests. The synthetic data calculations were based on the assumption that the atmospheric delay is homogeneous. To obviate the effects of water vapor new techniques were developed to resolve phase ambiguities, and for the pre-processing of the GPS data. The method was presented to resolve the wide-lane ambiguity by use of pseudo-range

measurements independent of baseline-length. The wide-lane ambiguity is required for the resolution of phase ambiguities for baselines in the range of 50 to 400 km. The problem of phase and pseudorange multipath is addressed. A method was developed that allows direction of this noise source without the requirement of repeated baseline measurements. Dissert. Abstr.

N90-27138*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.
CALIBRATION OF THE VISIBLE AND NEAR-INFRARED CHANNELS OF THE LANDSAT-5 THEMATIC MAPPER USING HIGH-ALTITUDE AIRCRAFT MEASUREMENTS
G. R. Smith, R. H. Levin, J. S. Knoll, R. S. Koyanagi (National Oceanic and Atmospheric Administration, Washington, DC.), and R. C. Wrigley Mar. 1990 17 p
(NASA-TM-102185; A-89107; NAS 1.15:102185) Avail: NTIS HC A03/MF A01 CSCL 08B

Visible near-infrared sensors mounted on operational satellites now in use do not have on-board full aperture absolute calibration devices. One means of establishing an in-orbit calibration for a satellite sensor is to make simultaneous measurements of a bright, uniform scene along the satellite view vector from a calibrated instrument on board a high altitude aircraft. In the work reported here, aircraft data were recorded over White Sands, New Mexico at satellite overpass time for the LANDSAT-5 Thematic Mapper (TM). A comparison of the coincident aircraft and orbiting satellite data showed the radiometric gain for TM channel 1 had degraded 4.7 percent by August 28, 1985; gains for TM channels 2 and 3 were within 1 percent of prelaunch values. Author

N90-27139# Geological Survey, Reston, VA.
NATIONAL MAPPING PROGRAM. FACT SHEET: BLACK AND WHITE PHOTOGRAPHS. NHAP (NATIONAL HIGH ALTITUDE PHOTOGRAPHY PROGRAM)
11 Jun. 1989 15 p
(Contract J5120169)
(PB90-185042; OSM-528) Avail: NTIS HC A03/MF A01 CSCL 08B

Since 1980, the multiagency National High Altitude Photography (NHAP) program has obtained both 1:80,000-scale black-and-white and 1:58,000-scale color-infrared photographs taken at an altitude of 40,000 feet. Photocoverage of the conterminous United States under NHAP was completed in FY 1988. As a result of the continuing assessment of Federal and State agency needs for multipurpose aerial photography, the participating Federal agencies have redesigned the former NHAP program to meet current requirements for higher resolution photographs. The new program is called the National Aerial Photography Program. Color-infrared photographs are being acquired at a scale of 1:40,000 from an altitude of 20,000 feet using a 6-inch focal length camera. Author

N90-27140*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
EARTH SCIENCES REQUIREMENTS FOR THE INFORMATION SCIENCES EXPERIMENT SYSTEM
David E. Bowker, ed., Steve J. Katzberg, ed., and R. Gale Wilson, ed. Washington Jul. 1990 220 p Workshop held in Williamsburg, VA, 1-4 May 1989
(NASA-CP-3072; L-16773; NAS 1.55:3072) Avail: NTIS HC A10/MF A02 CSCL 05B

The purpose of the workshop was to further explore and define the earth sciences requirements for the Information Sciences Experiment System (ISES), a proposed onboard data processor with real-time communications capability intended to support the Earth Observing System (Eos). A review of representative Eos instrument types is given and a preliminary set of real-time data needs has been established. An executive summary is included. For individual titles, see N90-27141 through N90-27161.

N90-27141*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
SPACE STATION ATTACHED PAYLOADS **c18**
Lenwood G. Clark *In its* Earth Sciences Requirements for the Information Sciences Experiment System Jul. 1990 p 7-20 (For primary document see N90-27140 21-43)
Avail: NTIS HC A10/MF A02 CSCL 22B

The Space Station Freedom is being designed and developed with user requirements being used to shape the configuration. Plans include accommodation provisions for a wide variety of attached payloads including the Earth sciences research activities which are the focus of this conference. The station program is even beginning some preliminary payload manifesting which involves planning for accommodation of payload during the station's assembly flights. Potential payload organizations should be aware of the station's plans for payload accommodations so as to guide their own payload activities for future space station use. Author

N90-27142*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
INFORMATION SCIENCES EXPERIMENT SYSTEM
Stephen J. Katzberg, Nicholas D. Murray, Harry F. Benz, David E. Bowker, and Herbert D. Hendricks *In its* Earth Sciences Requirements for the Information Sciences Experiment System Jul. 1990 p 21-32 (For primary document see N90-27140 21-43)
Avail: NTIS HC A10/MF A02 CSCL 05B

The rapid expansion of remote sensing capability over the last two decades will take another major leap forward with the advent of the Earth Observing System (Eos). An approach is presented that will permit experiments and demonstrations in onboard information extraction. The approach is a non-intrusive, eavesdropping mode in which a small amount of spacecraft real estate is allocated to an onboard computation resource. How such an approach allows the evaluation of advanced technology in the space environment, advanced techniques in information extraction for both Earth science and information science studies, direct to user data products, and real-time response to events, all without affecting other on-board instrumentation is discussed. Author

N90-27143*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
BASIC DATA REQUIREMENTS FOR MICROWAVE RADIOMETER SYSTEMS
R. W. Lawrence *In its* Earth Sciences Requirements for the Information Sciences Experiment System Jul. 1990 p 33-44 (For primary document see N90-27140 21-43)
Avail: NTIS HC A10/MF A02 CSCL 14B

Microwave radiometry has emerged over the last two decades to become an integral part of the field of environmental remote sensing. Numerous investigations were conducted to evaluate the use of microwave radiometry for atmospheric, oceanographic, hydrological, and geological applications. Remote sensing of the earth using microwave radiometry began in 1968 by the Soviet satellite Cosmos 243, which included four microwave radiometers (Ulably, 1981). Since then, microwave radiometers were included onboard many spacecraft, and were used to infer many physical parameters. Some of the basic concepts of radiometric emission and measurement will be discussed. Several radiometer systems are presented and an overview of their operation is discussed. From the description of the radiometer operation the data stream required from the radiometer and the general type of algorithm required for the measurement is discussed. Author

N90-27144*# Lockheed Engineering and Sciences Co., Hampton, VA.
RADARS IN SPACE **c32**
Victor E. Delnore *In* NASA, Langley Research Center, Earth Sciences Requirements for the Information Sciences Experiment System Jul. 1990 p 45-59 (For primary document see N90-27140 21-43)
Avail: NTIS HC A10/MF A02 CSCL 17I

The capabilities of active microwave devices operating from space (typically, radar, scatterometers, interferometers, and altimeters) are discussed. General radar parameters and basic radar principles are explained. Applications of these parameters

and principles are also explained. Trends in space radar technology, and where space radars and active microwave sensors in orbit are going are discussed. B.G.

N90-27145*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
LIDAR INSTRUMENTS PROPOSED FOR EOS **c74**
William B. Grant and Edward V. Browell *In its* Earth Sciences Requirements for the Information Sciences Experiment System Jul. 1990 p 61-67 (For primary document see N90-27140 21-43)
Avail: NTIS HC A10/MF A02 CSCL 20F

Lidar, an acronym for light detection and ranging, represents a class of instruments that utilize lasers to send probe beams into the atmosphere or onto the surface of the Earth and detect the backscattered return in order to measure properties of the atmosphere or surface. The associated technology has matured to the point where two lidar facilities, Geodynamics Laser Ranging System (GLRS), and Laser Atmospheric Wind Sensor (LAWS) were accepted for Phase 2 studies for Eos. A third lidar facility Laser Atmospheric Sounder and Altimeter (LASA), with the lidar experiment EAGLE (Eos Atmospheric Global Lidar Experiment) was proposed for Eos. The generic lidar system has a number of components. They include controlling electronics, laser transmitters, collimating optics, a receiving telescope, spectral filters, detectors, signal chain electronics, and a data system. Lidar systems that measure atmospheric constituents or meteorological parameters record the signal versus time as the beam propagates through the atmosphere. The backscatter arises from molecular (Rayleigh) and aerosol (Mie) scattering, while attenuation arises from molecular and aerosol scattering and absorption. Lidar systems that measure distance to the Earth's surface or retroreflectors in a ranging mode record signals with high temporal resolution over a short time period. The overall characteristics and measurements objectives of the three lidar systems proposed for Eos are given. Author

N90-27146*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, MD.
EOS VISIBLE IMAGERS **c35**
W. L. Barnes *In* NASA, Langley Research Center, Earth Sciences Requirements for the Information Sciences Experiment System Jul. 1990 p 69-81 (For primary document see N90-27140 21-43)
Avail: NTIS HC A10/MF A02 CSCL 14B

Some of the proposed Earth Observing System (Eos) optical imagers are examined. These imagers include: moderate resolution imaging spectrometer (MODIS); geoscience laser ranging system (GLRS); high resolution imaging spectrometer (HIRIS); the intermediate thermal infrared spectrometer (ITIR); multi-angle imaging spectrometer (MISR); earth observing scanning polarimeter (EOSP); and the lightening imaging sensor (LIS). B.G.

N90-27147*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
SAGE 3: A VISIBLE WAVELENGTH LIMB SOUNDER **c35**
W. P. Chu, M. P. McCormick, J. Zawodny, and L. R. McMaster *In its* Earth Sciences Requirements for the Information Sciences Experiment System Jul. 1990 p 83-88 (For primary document see N90-27140 21-43)
Avail: NTIS HC A10/MF A02 CSCL 14B

A brief description is presented for the SAGE 3 (Stratospheric Aerosol and Gas Experiment 3) instrument that has been selected to fly onboard the National Polar Platform 1 (NPOP 1) for the Earth Observational System (Eos) in 1996. The SAGE 3 instrument will perform earth limb sounding with the solar occultation technique measuring the ultraviolet (UV), the visible, and the near infrared (IR) wavelength solar radiation. The instrument will produce atmospheric data for the vertical distribution of aerosol, ozone, nitrogen dioxide, water vapor, and oxygen. The details of the instrument design, data flow, and processing requirements are discussed. Author

N90-27148*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
DESCRIPTION OF SAFIRE FOR ISES **c46**
Jae H. Park *In its* Earth Sciences Requirements for the Information Sciences Experiment System Jul. 1990 p 89-90 (For primary document see N90-27140 21-43)
Avail: NTIS HC A10/MF A02 CSCL 04A

The SAFIRE (Spectroscopy of the Atmosphere using Far Infrared Emission) is a limb emission experiment using a far-IR Fourier transform spectrometer (FTS) and a mid-IR broadband multispectral radiometer covering the range 80 to 1600/cm. The purpose of this experiment is to obtain vertical distributions of temperature and key constituents of O(y), HO(y), NO(y), ClO(y), and BrO(y) families in the stratosphere, mesosphere, and thermosphere. The spectral channels and gases within each channel are summarized. The instrument includes a 48 element (6 x 8) Ge:GA detector array operating at 4 K in the far-IR and a 105 element (7 x 15) HgCdTe array operating at 80 K in the mid-IR. The SAFIRE uses four different scan modes for vertical coverage and resolution to address various scientific requirements. The SAFIRE data reduction will start with the retrieval of temperature profile as a function of pressure using two CO2 channel data. Constituent distributions then are obtained from other channel data using the retrieved temperature profile. The SAFIRE measurements are limited to the region above the tropopause because of radiance saturation by H2O and clouds. The computational capability necessary to process at the instrument data rate is estimated to be 19 MFLOPS for FTS data and 0.02 MFLOPS for radiometer data. It seems, therefore, that the real-time applications of SAFIRE data using an onboard processing device is not feasible. Although a temperature anomaly may be detected from the two CO2 radiometer channels using an onboard processor for the stratosphere, it is not possible to distinguish between CO2 outflux and temperature anomaly. Temperature anomaly does not, therefore, offer tropospheric information useful for real-time application. Author

N90-27149*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
ERBE AND CERES BROADBAND SCANNING RADIOMETERS
William L. Weaver and John E. Cooper *In its* Earth Sciences Requirements for the Information Sciences Experiment System Jul. 1990 p 91-103 (For primary document see N90-27140 21-43)
Avail: NTIS HC A10/MF A02 CSCL 04A

Broadband scanning radiometers have been used extensively on earth-orbiting satellites to measure the Earth's outgoing radiation. The resulting estimates of longwave and shortwave fluxes have played an important role in helping to understand the Earth's radiant energy balance or budget. The Clouds and the Earth Radiant Energy System (CERES) experiment is expected to include instruments with three broadband scanning radiometers. The design of the CERES instrument will draw heavily from the flight-proven Earth Radiation Budget Experiment (ERBE) scanner instrument technology and will benefit from the several years of ERBE experience in mission operations and data processing. The discussion starts with a description of the scientific objectives of ERBE and CERES. The design and operational characteristics of the ERBE and CERES instrument are compared and the two ground-based data processing systems are compared. Finally, aspects of the CERES data processing which might be performed in near real-time aboard a spacecraft platform are discussed, and the types of algorithms and input data requirements for the onboard processing system are identified. Author

N90-27150*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
TROPOSPHERIC SOUNDERS **c46**
H. A. Wallio *In its* Earth Sciences Requirements for the Information Sciences Experiment System Jul. 1990 p 105-114 (For primary document see N90-27140 21-43)
Avail: NTIS HC A10/MF A02 CSCL 04A

The Measurement of Air Pollution Satellites (MAPS) experiment

is a nadir-viewing gas correlation filter radiometer that has flow on the space shuttle in 1981 and 1984. The Tropospheric Radiometer for Atmospheric Chemistry and Environment Research (TRACER) is a proposed multi-level gas correlation filter radiometer experiment proposed for the Earth Observing System (Eos) and has received phase 1 approval. Each experiment is discussed.
Author

N90-27151*# College of William and Mary, Williamsburg, VA. Dept. of Computer Sciences.
DATA ANALYSIS TECHNIQUES **c82**
Steve Park *In* NASA, Langley Research Center, Earth Sciences Requirements for the Information Sciences for Experiment System Jul. 1990 p 115-122 (For primary document see N90-27140 21-43)
Avail: NTIS HC A10/MF A02 CSCL 05B

A large and diverse number of computational techniques are routinely used to process and analyze remotely sensed data. These techniques include: univariate statistics; multivariate statistics; principal component analysis; pattern recognition and classification; other multivariate techniques; geometric correction; registration and resampling; radiometric correction; enhancement; restoration; Fourier analysis; and filtering. Each of these techniques will be considered, in order.
Author

N90-27152*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
ONBOARD PROCESSOR TECHNOLOGY REVIEW
Harry F. Benz *In its* Earth Sciences Requirements for the Information Sciences Experiment System Jul. 1990 p 123-130 (For primary document see N90-27140 21-43)
Avail: NTIS HC A10/MF A02 CSCL 14B

The general need and requirements for the onboard embedded processors necessary to control and manipulate data in spacecraft systems are discussed. The current known requirements are reviewed from a user perspective, based on current practices in the spacecraft development process. The current capabilities of available processor technologies are then discussed, and these are projected to the generation of spacecraft computers currently under identified, funded development. An appraisal is provided for the current national developmental effort.
Author

N90-27153*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
BRIEF STATE-OF-THE-ART REVIEW ON OPTICAL COMMUNICATIONS FOR THE NASA ISES WORKSHOP **c74**
Herbert D. Hendricks *In its* Earth Sciences Requirements for the Information Sciences Experiment System Jul. 1990 p 131-137 (For primary document see N90-27140 21-43)
Avail: NTIS HC A10/MF A02 CSCL 20F

The current state of the art of optical communications is briefly reviewed. This review covers NASA programs, DOD and other government agency programs, commercial aerospace programs, and foreign programs. Included is a brief summary of a recent NASA workshop on optical communications. The basic conclusions from all the program reviews is that optical communications is a technology ready to be accepted but needed to be demonstrated. Probably the most advanced and sophisticated optical communications system is the Laser Intersatellite Transmission Experiment (LITE) system developed for flight on the Advanced Communications Technology Satellite (ACTS). Optical communications technology is available for the applications of data communications at data rates in the under 300 MBits/sec for nearly all applications under 2 times GEO distances. Applications for low-earth orbiter (LEO) to ground will allow data rates in the multi-GBits/sec range. Higher data rates are limited by currently available laser power. Phased array lasers offer technology which should eliminate this problem. The major problem of cloud coverage can probably be eliminated by look ahead pointing, multiple ground stations, and knowledge of weather conditions to control the pointing. Most certainly, optical communications offer a new spectral region to relieve the RF bands and very high data communications rates that will be required in less than 10 years to solve the communications problems on Earth.
Author

N90-27154*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
APPLICATIONS OF ISES FOR GEOLOGY **c46**
David E. Bowker *In its* Earth Sciences Requirements for the Information Sciences Experiment System Jul. 1990 p 139-143 (For primary document see N90-27140 21-43)
Avail: NTIS HC A10/MF A02 CSCL 08G

The principal applications for onboard data processing and real-time data transmission in the geological sciences are the detection of early warning signs of potential catastrophic events and the rapid assessment of impact and damage following major events. Also, the opportunity for quick look and supporting data during field investigations should not be disregarded. The Eos platforms are ideal for these applications because of the variety of earth sensing instruments and their differing modes of operation. Further study is required to define the role for each instrument and to assess how they can aid each other in establishing an improved output product.
Author

N90-27155*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
APPLICATIONS OF ISES FOR THE ATMOSPHERIC SCIENCES **c46**
James M. Hoell, Jr. *In its* Earth Sciences Requirements for the Information Sciences Experiment System Jul. 1990 p 145-158 (For primary document see N90-27140 21-43)
Avail: NTIS HC A10/MF A02 CSCL 04A

The proposed Information Sciences Experiment System (ISES) will offer the opportunity for real-time access to measurements acquired aboard the Earth Observation System (Eos) satellite. These measurements can then be transmitted to remotely located ground based stations. The application of such measurements to issues related to atmospheric science which was presented to a workshop convened to review possible application of the ISES in earth sciences is summarized. The proposed protocol for Eos instruments requires that measurement results be available in a central data archive within 72 hours of acquiring data. Such a turnaround of raw satellite data to the final product will clearly enhance the timeliness of the results. Compared to the time that results from many current satellite programs, the 72 hour turnaround may be considered real time. Examples are discussed showing how real-time measurements from one or more of the proposed Eos instruments could have been applied to the study of certain issues important to global atmospheric chemistry. Each of the examples discussed is based upon a field mission conducted during the past five years. Each of these examples will emphasize how real-time data could have been used to alter the course of a field experiment, thereby enhancing the scientific output. For the examples, brief overviews of the scientific rationale and objectives, the region of operation, the measurements aboard the aircraft, and finally how one or more of the proposed Eos instruments could have provided data to enhance the productivity of the mission are discussed.
Author

N90-27156*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, MD.
APPLICATIONS OF ISES FOR THE OCEANS **c48**
W. E. Esaias *In* NASA, Langley Research Center, Earth Sciences Requirements for the Information Sciences Experiment System Jul. 1990 p 159-163 (For primary document see N90-27140 21-43)
Avail: NTIS HC A10/MF A02 CSCL 08C

The need in oceanography for direct broadcast, why, and what type are discussed. Four reasons for support exist: need for real-time observations in support of field studies; need to back up point failures; need for experimentation with onboard processing and selection of data for direct broadcasting; and the need to develop future operational NOAA systems. Each of these areas is examined.
B.G.

N90-27157*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
APPLICATIONS OF ISES FOR COASTAL ZONE STUDIES c48
D. S. Bartlett *In its* Earth Sciences Requirements for the Information Sciences Experiment System Jul. 1990 p 165-168 (For primary document see N90-27140 21-43)
Avail: NTIS HC A10/MF A02 CSCL 08C

In contrast to the discipline- and process-oriented topics addressed, coastal zone studies are defined geographically by the special circumstances inherent in the interface between land and water. The characteristics of coastal zones which make them worthy of separate consideration are: (1) the dynamic nature of natural and anthropogenic processes taking place; (2) the relatively restricted spatial domain of the narrow land/water interface; and (3) the large proportion of the Earth's population living within coastal zones, and the resulting extreme pressure on natural and human resources. These characteristics place special constraints and priorities on remote sensing applications, even though the applications themselves bear close relation to those addressed by other elements of this report (e.g., oceans, ice, vegetation/land use). The discussion which follows first describes the suite of remote sensing activities relevant to coastal zone studies. Potential Information Sciences Experiment System (ISES) experiments will then be addressed within two general categories: applications of real-time data transmission and applications of onboard data acquisition and processing. Author

N90-27158*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
APPLICATIONS OF ISES FOR VEGETATION AND LAND USE
R. Gale Wilson *In its* Earth Sciences Requirements for the Information Sciences Experiment System Jul. 1990 p 169-187 (For primary document see N90-27140 21-43)
Avail: NTIS HC A10/MF A02 CSCL 02F

Remote sensing relative to applications involving vegetation cover and land use is reviewed to consider the potential benefits to the Earth Observing System (Eos) of a proposed Information Sciences Experiment System (ISES). The ISES concept has been proposed as an onboard experiment and computational resource to support advanced experiments and demonstrations in the information and earth sciences. Embedded in the concept is potential for relieving the data glut problem, enhancing capabilities to meet real-time needs of data users and in-situ researchers, and introducing emerging technology to Eos as the technology matures. These potential benefits are examined in the context of state-of-the-art research activities in image/data processing and management. Author

N90-27159*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, MD.
APPLICATIONS OF ISES FOR SNOW, ICE, AND SEA STATE
Alfred T. C. Chang and Victor E. Delnore (Planning Research Corp., Hampton, VA.) *In* NASA, Langley Research Center, Earth Sciences Requirements for the Information Sciences Experiment System Jul. 1990 p 189-196 (For primary document see N90-27140 21-43)
Avail: NTIS HC A10/MF A02 CSCL 08L

There will be six facility instruments on the NASA NPOP-1 and NPOP-2 and additional instruments on the Japanese and European satellites. Also, there are the 24 selected NASA instruments that may be flown on one of the platforms. Many of these instruments can provide data that could be very useful for real-time data studies in the snow and ice area. Any one instrument is not addressed in particular, but emphasis is placed on what is potentially possible using the capabilities of some of these instruments. Author

N90-27160*# Science and Technology Corp., Hampton, VA.
APPLICATIONS OF ISES FOR METEOROLOGY c47
Paul D. Try *In* NASA, Langley Research Center, Earth Sciences Requirements for the Information Sciences Experiment System Jul. 1990 p 197-211 (For primary document see N90-27140 21-43)
Avail: NTIS HC A10/MF A02 CSCL 04B

The results are summarized from an initial assessment of the potential real-time meteorological requirements for the data from Eos systems. Eos research scientists associated with facility instruments, investigator instruments, and interdisciplinary groups with data related to meteorological support were contacted, along with those from the normal operational user and technique development groups. Two types of activities indicated the greatest need for real-time Eos data: technology transfer groups (e.g., NOAA's Forecasting System Laboratory and the DOD development laboratories), and field testing groups with airborne operations. A special concern was expressed by several non-U.S. participants who desire a direct downlink to be sure of rapid receipt of the data for their area of interest. Several potential experiments or demonstrations are recommended for ISES which include support for hurricane/typhoon forecasting, space shuttle reentry, severe weather forecasting (using microphysical cloud classification techniques), field testing, and quick reaction of instrumented aircraft to measure such events as polar stratospheric clouds and volcanic eruptions. Author

N90-27161*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
APPLICATIONS OF ISES FOR INSTRUMENT SCIENCE c35
William B. Grant *In its* Earth Sciences Requirements for the Information Sciences Experiment System Jul. 1990 p 213-215 (For primary document see N90-27140 21-43)
Avail: NTIS HC A10/MF A02 CSCL 14B

It is often the case that some instruments being used for geophysical measurements cannot measure some parameters that are important for processing the data obtained using the instrument. However, the parameters of interest may be measured by other instruments and these data made available to the operators of the first instrument. Processing the data immediately after it is acquired is useful in directing the operation of the same or different instrument or in providing a quick look data set to users on the ground. The four applications which are considered are: the decision to acquire data due to some important occurrence detected by Eos instruments; the decision not to acquire data at a scheduled time and/or location; the decision to acquire additional data to improve data quality; and combining data from several sources to enhance data quality. General examples are presented, which may or may not apply directly to Eos instruments on the various platforms. Author

N90-27162# Cologne Univ. (Germany, F.R.). Inst. fuer Geophysik und Meteorologie.
MODELING AND MEASUREMENT OF TREE CANOPY REFLECTANCE [MODELLIERUNG UND MESSUNG DER REFLEXIONSEIGENSCHAFTEN VON PFLANZENBESTAENDEN]
Christian vonRuesten 1989 105 p In GERMAN; ENGLISH summary
(Mitt-66; ISSN-0069-5882; ETN-90-97327) Avail: NTIS HC A06/MF A01

Development of mathematical modeling and measurement of tree canopy reflectance is described. The importance of botanical and meteorological parameters in determining the reflectance is shown. Results of modeling distribution of directional reflectance factors are presented and compared with measurements. Good correspondence of results is shown. Radiation distributions calculated with an atmospheric model using different aerosols over an isotropic reflecting canopy are presented. The results obtained by combining both models are discussed. ESA

N90-27215# Meteorological Satellite Center, Tokyo (Japan). System Engineering Div.
REPRODUCTION OF GMS IR CALIBRATION TABLE
Hideyuki Sasaki *In its* Meteorological Satellite Center Technical Note, No. 17, 1988 Nov. 1988 p 9-13 (For primary document see N90-27213 21-47)
Avail: NTIS HC A06/MF A01

N90-27223# Japan Meteorological Agency, Tokyo.
AN EXPERIMENT TO MAKE A NEW DESIGN OF THE SATELLITE CLOUD INFORMATION CHART WITH THE COMBINATION OF VISIBLE AND INFRARED DATA OBSERVED BY THE GMS
Toshihiro Motoki *In* Meteorological Satellite Center, Meteorological Satellite Center Technical Note, No. 17, 1988 Nov. 1988 p 111-122 In JAPANESE; ENGLISH summary (For primary document see N90-27213 21-47)
Avail: NTIS HC A06/MF A01

44 ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells; global sources of energy; geophysical conversion; and windpower.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *28 Propellants and Fuels.*

N90-27163# Midwest Research Inst., Golden, CO. Solar Energy Research Inst.
THE POTENTIAL OF RENEWABLE ENERGY
Mar. 1990 194 p Meeting of the DOE National Laboratories for National Energy Strategy, 27-28 Jun. 1989 Prepared in cooperation with Idaho National Engineering Lab., Idaho Falls; LANL, NM; ORNL, TN; and Sandia National Labs., Albuquerque, NM
(Contracts DE-AC02-83CH-10093; DE-AC07-76ID-01570; W-7405-eng-36; DE-AC05-84OR-21400)
(DE90-000322; SERI/TP-260-3674) Avail: NTIS HC A09/MF A01

On June 27 and 28, 1989, the U.S. DOE national labs were convened to discuss plans for the development of a National Energy Strategy (NES) and, in particular, the analytic needs in support of NES that could be addressed by the labs. As a result of that meeting, interlabor teams were formed to produce analytic white papers on key topics, and a lead lab was designated for each core lab team. The broad-ranging renewables assignment is summarized by the following issue statement from the Office of Policy, Planning and Analysis: to what extent can renewable energy technologies contribute to diversifying sources of energy supply; What are the major barriers to greater renewable energy use and what is the potential timing of widespread commercialization for various categories of applications. The results are presented of the intensive activity initiated by the June 1989 meeting to produce a white paper on renewable energy. DOE

N90-27164# AIA Research Corp., Washington, DC.
OPPORTUNITIES IN SOLAR ENERGY RESEARCH OVER THE NEXT DECADE
E. Kennett, comp. 1 Jun. 1989 23 p
(Contract DE-FG03-88SF-17538)
(DE90-012479; DOE/SF-17538/T5) Avail: NTIS HC A03/MF A01

A sustainable energy path that relies on renewable energy sources can provide policymakers with the flexibility to cope with an uncertain national and global future. Improving market pricing signals, opening up the energy supply and energy savings business, educating society to see the true present value of future savings, and reinvigorating research and development programs will be difficult. However, those nations that accept the challenge will be rewarded with increased energy security, more stable economies, and a healthier global environment. The following report is an overview of eight trends in our society that are expected to shape the nature of architecture at the turn of the century. These trends will have pronounced effects on the use of renewable energy in our building stock. In turn, solar energy research can provide the answers to certain questions which will arise during these changes. Changes, if understood, can also serve to accelerate the inclusion of certain technologies, as in this particular case, solar energy. DOE

N90-27165# Midwest Research Inst., Golden, CO.
RECENT TECHNOLOGICAL ADVANCES IN THIN FILM SOLAR CELLS
Harin S. Ullal, Kenneth Zweibel, and Thomas Surek Mar. 1990 5 p Presented at the World Renewable Energy Congress, Reading, England, 23-28 Sep. 1990
(Contract DE-AC02-83CH-10093)
(DE90-000321; SERI/TP-211-3679; CONF-900901-1) Avail: NTIS HC A01/MF A01

High-efficiency, low-cost thin film solar cells are an exciting photovoltaic technology option for generating cost-effective electricity in 1995 and beyond. This paper reviews the substantial advances made by several thin film solar cell technologies, namely, amorphous silicon, copper indium diselenide, cadmium telluride, and polycrystalline silicon. Recent examples of utility demonstration projects of these emerging materials are also discussed. DOE

N90-27166# Midwest Research Inst., Golden, CO.
WIND LOADS AND LOCAL PRESSURE DISTRIBUTIONS ON PARABOLIC DISH SOLAR COLLECTORS Final Report
J. A. Peterka, R. G. Derickson, and J. E. Cermak (Colorado State Univ., Fort Collins.) May 1990 226 p
(Contract DE-AC02-83CH-10093)
(DE90-000328; SERI/TP-253-3668) Avail: NTIS HC A11/MF A02

The research and development described in this document was conducted within the U.S. Department of Energy's Solar Thermal Technology Program. The goal of this program is to advance the engineering and scientific understanding of solar thermal technology and the establish the technology base from which private industry can develop solar thermal power production options for introduction into the competitive energy market. This report presents the results of wind-tunnel tests supported through the Solar Energy Research Institute (SERI) by the Office of Solar Thermal Technology of the U.S. Department of Energy as part of the SERI research effort on innovative concentrators. As gravity loads on drive mechanisms are reduced through stretched-membrane technology, the wind-load contribution of the required drive capacity increases in percentage. Reduction of wind loads can provide economy in support structure and collector drive. Wind-tunnel tests have been directed at finding methods to reduce wind loads on parabolic dish collectors. The tests investigated the mean and peak forces, moments and local pressure distributions. A significant increase in the understanding and prediction of peak parabolic dish wind loads and their reduction within a field was achieved. DOE

N90-27167# Midwest Research Inst., Golden, CO.
POLYCRYSTALLINE THIN FILM CADMIUM TELLURIDE n-i-p SOLAR CELLS
P. V. Meyers (Ametek, Inc., Harleysville, PA.) Jun. 1990 60 p
(Contract DE-AC02-83CH-10098)
(DE90-000351; SERI/TP-211-3873) Avail: NTIS HC A04/MF A01

This paper discusses experiments and analyses of technical, economic and environmental issues relating to CdTe n-i-p solar cells and their potential to satisfy the DOE PV program goals. The basic cell structure is CdS-CdTe-ZnTe. Included is an experimental and theoretical study of the operation of these devices. Experiments related to deposition of the CdS and ZnTe layers, cascaded solar cells, and module fabrication are described. Manufacturing issues relating to costs, worker safety, and environmental security are discussed. DOE

N90-27168# Japan Solar Energy Society, Tokyo.
ABSTRACTS OF 1989 JAPAN SOLAR ENERGY SOCIETY AND JAPAN WIND ENERGY ASSOCIATION JOINT CONFERENCE
Dec. 1989 283 p In JAPANESE Conference held in Kawasaki, Japan, 7 Dec. 1989 Prepared in cooperation with Japan Wind

Energy Association, Tokyo, Japan
(DE90-503616; CONF-8912100-Absts) Avail: NTIS (US Sales Only) HC A13/MF A02

These abstracts are the abstracts presented at the 1989 Joint Conference. Some abstracts in one session concerned global solar radiation, meteorological forecasting and solar radiation on a tilted surface, etc. under the title of solar radiation, others concerned various heat collecting devices, etc. under the the title of heat collectors, others concerned photosynthesis under the title of utilization of solar beams, others concerned a sol-air system, etc. under the title of heat pumps and others concerned solar cells under the title of solar beam power generation-basic. Another session presented papers concerning various systems utilizing solar heat under the title of system assessment, passive solar housing under the title of passive solar, windmills, etc. under the title of utilization of wind force, under the title of material, practical utilization of solar beam power generation under the title of solar beam power generation-application, and heat storage and heat transportation, etc. under the title of heat transportation and heat storage. DOE

N90-27169# Texas A&M Univ., College Station. Center for Electro-Chemical Systems and Hydrogen Research.
A LIGHTWEIGHT SOLID POLYMER ELECTROLYTE FUEL CELL WITH STACK POWER DENSITY OF 3 kW/lb (7kW/kg)
A. J. Appleby and S. Srinivasan 1 Jun. 1990 10 p
(Contract N00014-88-K-0389)
(AD-A223068; Rept-6035) Avail: NTIS HC A02/MF A01 CSCL 10/3

The physico-chemical properties of some solid polymer electrolytes were investigated as well as of electrode kinetic parameters of oxygen reduction at the platinum/solid polymer electrolyte interface; optimize electrodes and membrane/electrode assemblies to attain the highest possible power density in fuel cells; and model the performance of an electrochemical cell stack taking into consideration the electrochemical, mass transfer and heat transfer characteristics to demonstrate the feasibility of attaining the stated goals. Highlights of the accomplishments on these tasks are as follows: using a microelectrode technique, the electrode kinetic parameters for oxygen reduction at the platinum-solid polymer electrolyte interface and the oxygen solubility and diffusion coefficient in this electrolyte were determined; with optimized electrode structures and membrane/electrode assemblies, high power densities were attained in solid polymer electrolyte fuel cells (single cells); and the modeling studies reveal that thermal and water management can be effective with recirculation of gases with external condensation, and with thin metallic bipolar plates and assuming a power density of 4 watts/centimeters squared a stack power density of 7 kW/kg can be achieved. GRA

N90-27170# Massachusetts Inst. of Tech., Cambridge. Lab. for Electromagnetic and Electronic Systems.
LINEAR AVERAGED AND SAMPLED DATA MODELS FOR LARGE SIGNAL CONTROL OF HIGH POWER FACTOR ac-dc CONVERTERS
K. Mahabir, G. Verghese, J. Thottuvelil, and A. Heyman (Digital Equipment Corp., Maynard, MA.) Jun. 1990 11 p Sponsored in part by Digital Equipment Corp., Maynard, MA
(Grant AF-AFOSR-0032-88; AF Proj. 2304)
(AD-A221976; LIDS-P-1968; AFOSR-90-0560TR) Avail: NTIS HC A03/MF A01 CSCL 10/2

It is shown that the large signal behavior of a popular family of high power factor ac to dc power conditioners can be analyzed via linear models, by using squared output voltage as the state variable. The state equation for a general (constant power plus resistive) load is obtained by a simple dynamic power balance. Time invariant or periodically varying controllers, acting at the time scales of the line or switching periods respectively, can then be designed from the resulting averaged or sampled data models. Simulations and experiments corroborate the results. GRA

N90-27171# Massachusetts Inst. of Tech., Cambridge. Lab. for Electromagnetic and Electronic Systems.
GENERALIZED AVERAGING METHOD FOR POWER CONVERSION CIRCUITS
Seth R. Sanders, J. Mark Noworolski, Xiaojun Z. Liu, and George C. Verghese Jun. 1990 9 p Presented at the IEEE Power Electronics Specialists Conference, San Antonio, TX, Jun. 1990 Sponsored by Tandem Computer, Inc. Prepared in coooperation with California Univ., Berkeley
(Grants AF-AFOSR-0032-88; NSF MIP-87-15235; AF Proj. 2304)
(AD-A221977; LIDS-P-1970; AFOSR-90-0558TR) Avail: NTIS HC A02/MF A01 CSCL 10/2

The method of state-space averaging has been successfully applied to pulse-width modulated power converters, but has its limitations with switched circuits that do not satisfy a small ripple condition. This work considers a more general averaging procedure that encompasses state-space averaging and is potentially applicable to a much broader class of circuits and systems. In particular, the technique is shown to be effective on a number of examples including resonant type converters. GRA

N90-27172# Minnesota Univ., Minneapolis. Corrosion Research Center.
CELL PERFORMANCE OF ULTRA-THIN POLYMER CATHODE CELL SYSTEMS. PART 2: CATION INTERCALATING COMPOSITE POLYMER CATHODE Technical Report, 1 Jan. 1989 - 1 Mar. 1990
Katsuhiko Naoi, William H. Smyrl, and Boone B. Owens 15 Mar. 1990 13 p
(Contract N00014-88-K-0360)
(AD-A221919; TR-25-ONR) Avail: NTIS HC A03/MF A01 CSCL 10/3

Theoretical specific energy and power densities for thin film Li/LE or SPE/CP cell systems were calculated by modeling a bipolar-design polymer cathode rechargeable cell with hardware where LE, SPE and CP represent the liquid electrolyte (2M LiClO4(PC)), solid polymer electrolyte (PEO(8)LiX) and the conductive polymer(polypyrrole). The cell performance is obtained for a cation intercalating PPy-PVS composite film which is composed of polypyrrole(PPy) into which has been incorporated the polymer anion, polyvinyl solfonate(PVS) during deposition. The energy and power densities are estimated as a function of cathode thickness (1 to 100,000 micron), active cell area (1 to 10,000 sq cm) and the number of bipolar units (1 to 100). Compared to the anion consuming polymer cathode system, significant enhancement of specific energy was achieved. The theoretical specific energy amounts to ca. 290 Wh/kg (bare cell) and ca. 209 Wh/kg for a bipolar Li/LE or SPE/PPy-PVS cell system (with hardware). GRA

45 ENVIRONMENT POLLUTION

Includes atmospheric, noise, thermal, and water pollution.

N90-27173# Martin Marietta Aerospace, Denver, CO.
ATMOSPHERIC DISPERSION OF SOLID AND LIQUID ROCKET PROPELLANTS Final Report, Sep. 1987 - Jan. 1989
Robert W. Knight and Stephen P. Prince Jan. 1989 120 p
(Contract F04701-86-C-0074; AF Proj. 2103)
(AD-A221293; MCR-87-052; AFESC/ESL-TR-88-35) Avail: NTIS HC A06/MF A01 CSCL 13/2

Analysis of source strength determinations for the Titan 34D launch vehicle system has been completed. This system uses approximately 929,000 lbs of solid rocket propellant (PBAN-based ammonium perchlorate propellant with powdered aluminum foil), and 402,000 lbs of hypergolic liquid rocket propellant (consisting of 134,000 lbs of Aerozine-50 (hydrazine and unsymmetrical dimethyl hydrazine (UDMH)) and 268,000 lbs of nitrogen tetroxide oxidizer). The analysis was performed to evaluate the Titan 34D vehicle in which combustion gases and unreacted propellants are released into the atmosphere. Results of this study will incorporate

an existing atmospheric dispersion computer program in use at the Eastern and Western Test Missile Ranges. Analytical results from the characterization of an accident involving both solid and liquid rocket propellants include the determination of the fireball size, a diabatic flame temperature, gas composition, average molecular weight of products, and radiative heat fluxes. Analyses were performed for the Titan 34D in two configurations: transtage upper stage, and inertial upper stage. GRA

N90-27174# Spectral Sciences, Inc., Burlington, MA.
ATMOSPHERICALLY INDUCED OPTICAL CONTAMINATION FROM ORBITING THRUSTERS Scientific Report No. 1, 9 May 1988 - 31 Aug. 1989
J. B. Elgin (RADEX, Inc., Bedford, MA.) and M. Tautz 19 Sep. 1989 66 p
(Contract F19628-88-C-0074; AF Proj. 7601)
(AD-A223112; SSI-TR-160; GL-TR-89-0263) Avail: NTIS HC A04/MF A01 CSCL 03/2

This paper presents the result of the SOCRATES (Shuttle Orbiter Contamination Representation Accounting for Transiently Emitted Species) code which has been developed to assess the effects of contamination of measurements aboard spacecraft in low earth orbit. SOCRATES is a Monte Carlo code which includes in its present version scattering, collisions leading to kinetic-to-vibrational energy transfer, and reactive collisions. The application of this code to actual measurements aboard spacecraft in low earth orbit makes it possible to evaluate data obtained on these platforms with a view towards extracting the data of interest from contaminated signals. GRA

N90-27216# Meteorological Satellite Center, Tokyo (Japan).
DISTRIBUTION AND MOVEMENT OF SMOKES FROM FOREST FIRES THAT OCCURRED ALONG THE BOUNDARY OF THE PEOPLE'S REPUBLIC OF CHINA AND THE USSR ON APRIL-MAY 1987
Tadashi Aso and Seiichiro Kigawa *In its* Meteorological Satellite Center Technical Note, No. 17, 1988 Nov. 1988 p 15-29 In JAPANESE; ENGLISH summary Original contains color illustrations (For primary document see N90-27213 21-47)
Avail: NTIS HC A06/MF A01

46 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation see *93 Space Radiation.*

N90-27175*# Wisconsin Univ., Madison. Dept. of Meteorology.
A STUDY OF THE EFFECT OF SYNOPTIC SCALE PROCESSES IN GCM MODELLING Final Technical Report, 15 Jan. 1978 - 31 Dec. 1987
Gerald F. Herman 9 Mar. 1989 18 p
(Grant NsG-5223)
(NASA-CR-184804; NAS 1.26:184804) Avail: NTIS HC A03/MF A01 CSCL 04A

Research was conducted to help modeling groups at NASA to develop better weather forecasting and general circulation models (GCM) for activities relating to the meteorological uses of satellite data. The focus was on the physical processes that were being simulated by models: radiative effects and latent heat release associated with clouds; orographic influences; and heat transfer at the ocean and ice surfaces. An attempt was made to deduce the role of diabatic heating in North Atlantic cyclogenesis and in the global heat budget. Inferences were made in four studies: heat budget statistics from GCM assimilations; dynamics of north Atlantic cyclones; Cage-type energy budget calculations; and grid scale cloud formation. Mechanisms that were responsible for the variability and structure of the atmospheric on a hemispheric scale were studied by a hybrid of statistical analysis and theoretical modeling. Variability and structure are both related to synoptic scale processes through baroclinic and barotropic energy transformations. E.R.

N90-27176*# Lunar and Planetary Inst., Houston, TX.
MEVTV WORKSHOP ON EARLY TECTONIC AND VOLCANIC EVOLUTION OF MARS
H. Frey, ed. 1988 105 p Workshop held in Easton, MD, 5-7 Oct. 1988
(Contract NASw-4066)
(NASA-CR-186098; NAS 1.26:186098; LPI-TR-89-04) Avail: NTIS HC A06/MF A01 CSCL 08G

Although not ignored, the problems of the early tectonic and volcanic evolution of Mars have generally received less attention than those later in the evolution of the planet. Specifically, much attention was devoted to the evolution of the Tharsis region of Mars and to the planet itself at the time following the establishment of this major tectonic and volcanic province. By contrast, little attention was directed at fundamental questions, such as the conditions that led to the development of Tharsis and the cause of the basic fundamental dichotomy of the Martian crust. It was to address these and related questions of the earliest evolution of Mars that a workshop was organized under the auspices of the Mars: Evolution of Volcanism, Tectonism, and Volatiles (MEVTV) Program. Four sessions were held: crustal dichotomy; crustal differentiation/volcanism; Tharsis, Elysium, and Valles Marineris; and ridges and fault tectonics. Author

N90-27177# Finnish Meteorological Inst., Helsinki. Geophysics Dept.
PROCEEDINGS OF THE INTERNATIONAL WORKSHOP ON GEOMAGNETIC OBSERVATORY DATA ACQUISITION AND PROCESSING
Kirsti Kauristie, ed., Christian Sucksdorff, ed., and Heikki Nevanlinna, ed. 15 Feb. 1990 150 p In ENGLISH and FRENCH Workshop held in Nurmijaervi, Finland, 15-25 May 1989
(Geophysical-Publ-15; ISBN-951-697-314-0; ISSN-0782-6087)
Avail: NTIS HC A07/MF A01

At the beginning of the workshop, the magnetic instruments of the representatives were tested for sensitivities and orientations of the sensors in a coil hut specially built for this purpose. After this, the instruments were installed in a calibration house where they recorded the geomagnetic field for six days. During these days, lectures were held and instruments and data processing in geomagnetic observatories were discussed. Also, absolute measurements were performed. Comparisons of the recording instruments, the lectures, and the results of the absolute measurements are presented. For individual titles, see N90-27178 through N90-27194.

N90-27178# Finnish Meteorological Inst., Helsinki.
THE NURMIJARVI GEOPHYSICAL OBSERVATORY
Kari Pajunpaa *In its* Proceedings of the International Workshop on Geomagnetic Observatory Data Acquisition and Processing 15 Feb. 1990 p 15-16 (For primary document see N90-27177 21-46)
Avail: NTIS HC A07/MF A01

The Nurmijarvi Geophysical Observatory was founded in 1951 about 40 km north of Helsinki on an isolated site with almost untouched nature. The observatory lies in a pine forest on the southern shore of Lake Saaksjarvi. The main task of the observatory is to record geomagnetic field and its variations. Other observations include pulsation recording, ionospheric riometer measurements, observations of radioactivity, aerosol and rainwater sampling, and climatic observations. The observatory was built on an area where the magnetic field is sufficiently undisturbed for continuous magnetic recordings. E.R.

N90-27179# Finnish Meteorological Inst., Helsinki. Dept. of Geophysics.
COIL SYSTEM FOR THE PRODUCTION OF THREE-COMPONENT UNIFORM MAGNETIC FIELD AT THE NURMIJARVI OBSERVATORY c70

L. Hakkinen, Jouni Ryno, and Christian Sucksdorff *In its* Proceedings of the International Workshop on Geomagnetic Observatory Data Acquisition and Processing 15 Feb. 1990 p 17-22 (For primary document see N90-27177 21-46)
Avail: NTIS HC A07/MF A01

Following the design by Alldred and Scollar, a three component coil system composed of three sets of four square coils was constructed. The lengths of the sides of the smallest coils are 1.7 m and of the largest coils 2.3 m leaving enough room in the middle for working with the instruments to be tested. The homogeneity of the field was figured in different parts of the volume and found to be better than one part in 10 (exp -5) within a sphere of about 30 cm in diameter for the 2.3 m coil. Drawings showing the isolines within the coils are given. The homogeneity of the fields of the real coil systems were also measured experimentally and found close to the theoretical ones. Author

N90-27180# Finnish Meteorological Inst., Helsinki. Dept. of Geophysics.
MEASURING SENSITIVITIES AND ORTHOGONALITIES OF MAGNETOMETER SENSORS IN THE NURMIJARVI COIL HUT **c70**

L. Hakkinen and Jouni Ryno *In its* Proceedings of the International Workshop on Geomagnetic Observatory Data Acquisition and Processing 15 Feb. 1990 p 37-39 (For primary document see N90-27177 21-46)
Avail: NTIS HC A07/MF A01

The three component square coil system in the Nurmijarvi observatory was built especially for the purpose of determining the sensitivities and the orthogonalities of magnetometer sensors. The way this is done and the mathematical algorithm for computing the sensitivities and directions of the magnetometer sensors are described. Author

N90-27181# Finnish Meteorological Inst., Helsinki. Dept. of Geophysics.
COMPARISONS OF THE RECORDING INSTRUMENTS. DESCRIPTION OF THE DIFFERENCE-PLOTS **c35**

L. Hakkinen *In its* Proceedings of the International Workshop on Geomagnetic Observatory Data Acquisition and Processing 15 Feb. 1990 p 40-66 (For primary document see N90-27177 21-46)
Avail: NTIS HC A07/MF A01

Following the tests in the coil house, the sensors of the recording instruments were installed in the calibration house. The results of the comparison recording are given. As a general conclusion, it is easy to see that there is a clear improvement in the instruments since the Ottawa Workshop: all the instruments, after being corrected for the effects of orientations and temperature, behave rather well most of the time, even during magnetic disturbances showing variations of only a few nanoteslas compared to tens of nanoteslas in Ottawa. Encouraging is the long term stability of most of the instruments shown during the naturally too short period of six days. It may also be concluded that the recordings still seem not to be good enough for an accuracy of one nanotesla. Mysterious variations with amplitudes from 1 to 3 nanoteslas occur in instruments. Only this kind of comparison can reveal these errors. E.R.

N90-27182# Institut de Physique du Globe, Paris (France). Dept. de Geomagnetisme.
A NEW METHOD FOR THE ABSOLUTE MEASUREMENT OF GEOMAGNETISM BEGINNING WITH DI FLUX [NOUVELLE METHODOLOGIE POUR LES MESURES ABSOLUES MAGNETIQUES A PARTIR D'UN APPAREILLAGE D-I-FLUX] **c70**

D. Gilbert *In* Finnish Meteorological Inst., Proceedings of the International Workshop on Geomagnetic Observatory Data Acquisition and Processing 15 Feb. 1990 p 67-71 In FRENCH (For primary document see N90-27177 21-46)
Avail: NTIS HC A07/MF A01

The method, which is a variation of one described by K. Lauridsen and elsewhere by the author, is called RESIDU. It offers two advantages: it is faster and simpler to execute than ZEROS; and the reading of RESIDU in small degrees is easy and the results are, to some extent, more precise in the unsteady range. The measurement consist of a reading the residual value of the display in the delta R field, in nanoTesla, marked in four fixed directions of a level probe. These directions turns by 200 degs whose division value is given in a directional reading approaching 0 and 1/10 degs. Transl. by E.R.

N90-27183# Danish Meteorological Inst., Copenhagen.
EXPERIENCES WITH MODERN ABSOLUTE INSTRUMENTS

E. Kring Lauridsen *In* Finnish Meteorological Inst., Proceedings of the International Workshop on Geomagnetic Observatory Acquisition and Processing 15 Feb. 1990 p 72-75 (For primary document see N90-27177 21-46)
Avail: NTIS HC A07/MF A01

The author has worked with geomagnetic instruments for more than 40 years and had arrived at the attitude that it was hardly worth while to devote one's time to fractions of a nT because there were so many sources of error which came into play when you approached this accuracy. Lately, the author has changed his mind. It seems that modern instruments are definitely better than the classical instruments, and it is now possible to measure, even absolutely, with an accuracy of less than 1 nT. A historical account is given of when and why a shift was made from classical to electronic instruments in our observatories in Denmark and Greenland. E.R.

N90-27184# Institut de Physique du Globe, Paris (France).
INSTITUT DE PHYSIQUE DU GLOBE DE PARIS AUTOMATIC MAGNETIC OBSERVATORY

Francois-Xavier Lalanne *In* Finnish Meteorological Inst., Proceedings of the International Workshop on Geomagnetic Observatory Data Acquisition and Processing 15 Feb. 1990 p 76-79 (For primary document see N90-27177 21-46)
Avail: NTIS HC A07/MF A01

Since 1986 the Department of Geomagnetism of Institut de Physique du Globe de Paris has been involved in two programs which need instrumentation development in fluxgate magnetometer. The first one, MAGNOLIA, is a project of space magnetic observatory with a previous duration of 5 years, the second one, Observatoire Magnetique planetaire (OMP) is a worldwide project of 15 to 20 automatic magnetic observatories. The project is a major contribution to the international INTERMAGNET project. These projects are discussed. Author

N90-27185# Istituto Nazionale di Geofisica, Rome (Italy).
IMPROVEMENTS OF AUTOMATIC MAGNETIC OBSERVATORIES IN ITALY

Antonio Meloni and Paolo Palangio (Osservatorio Geofisico Castello, L'Aquila, Italy) *In* Finnish Meteorological Inst., Proceedings of the International Workshop on Geomagnetic Observatory Data Acquisition and Processing 15 Feb. 1990 p 80-86 (For primary document see N90-27177 21-46)
Avail: NTIS HC A07/MF A01

Recording temporal variations of the geomagnetic field in digital form is now a usual procedure in many geomagnetic observatories. Two Italian magnetic observatories now run using a method of a quasi absolute digital acquisition of data of geomagnetic total field and of the components of the field based on the use of a proton precession magnetometer equipped with two Helmholtz coils. A microprocessor is used to transform the magnetometer signal frequency to obtain the absolute values of the components and to automate the set of measurements. The optimization of the procedures after a few years of experience at L'Aquila and Castel Tesino geomagnetic observatories and the newly introduced clinometric control for checking the stability of components, are discussed. Author

N90-27186# Soviet Geophysical Committee, Moscow (USSR).
DIGITAL INTELLIGENT MAGNETIC RECORDING SYSTEM DIMARS AS THE AUTOMATED WORKSTATION AT MAGNETIC OBSERVATORY

N. E. Papitashvili, V. O. Papitashvili, L. Hegymegi, A. Kormendi, and T. Lomniczi (Tihany Geophysical Observatory, Hungary) *In* Finnish Meteorological Inst., Proceedings of the International Workshop on Geomagnetic Observatory Data Acquisition and Processing 15 Feb. 1990 p 87-92 (For primary document see N90-27177 21-46)
Avail: NTIS HC A07/MF A01

The main concept of the Digital Intelligent Magnetic Recording System (DIMARS) for the registration of the Earth's magnetic field variations is the following: with the help of an embedded microprocessor it provides the necessary automated functions which provide a maximum available information for the annual report of a magnetic observatory. In this way the problem of compactness of the storage unit (5.25 inch floppy disk) with IBM PC XT/AT (or clone) has been solved. The functional block diagram of DIMARS is shown. The system permits the use of PC separately for the floppy processing and transmitting the files into PC via telephone link without changing a diskette. A standard matrix printer of PC can be used for recording of standard magnetogram with the 20 mm/h speed (in graphic mode). It is possible to attach a digital compact cassette magnetic recorder too. Quartz variometers with analog electric output are used in the system, but it is also possible to attach any other variometers, e.g., fluxgate sensors, etc. to the system. Author

N90-27187# Danish Meteorological Inst., Copenhagen.
IMPROVEMENTS IN FLUXGATE MAGNETOMETERS AT DANISH METEOROLOGICAL INSTITUTE'S MAGNETIC OBSERVATORIES
O. Rasmussen *In* Finnish Meteorological Inst., Proceedings of the International Worshop on Geomagnetic Observatory Data Acquisition and Processing 15 Feb. 1990 p 93-102 (For primary document see N90-27177 21-46)
Avail: NTIS HC A07/MF A01

Pier tilting was found to cause severe drift problems in stations with poor foundation possibilities. A band suspended fluxgate magnetometer was constructed, which during the first year showed a drift of less than 1 nT/yr in H and Z. A poorer result for the D component is thought to be caused by the mechanical design. Large temperature coefficients in fluxgate sensors is a problem especially if they are not well defined. Also it is costly to heat the variometer house to a high temperature to avoid temperature variations. To improve this, Pandect (EDA) sensors were fixed inside quartz tubes on which were wound new compensating coils. The temperature coefficients for these sensors is 0.1 nT/C in large fields. New electronics were made to match the temperature coefficients of the sensors. The electronics can be placed close to the sensors so that the whole magnetometers can be housed in a thermostated box of 1 cu m to save energy. Author

N90-27188# Gem Systems, Inc., Richmond Hill (Ontario).
PROTON MAGNETOMETERS FOR MEASUREMENT OF THE EARTH'S MAGNETIC FIELD
Ivan Hrvoic *In* Finnish Meteorological Inst., Proceedings of the International Workshop on Geomagnetic Observatory Data Acquisition and Processing 15 Feb. 1990 p 103-109 (For primary document see N90-27177 21-46)
Avail: NTIS HC A07/MF A01

Proton magnetometers are an excellent example of nuclear physics phenomena brought into and exploited in our normal, macroscopic world. Relatively easy and efficient manipulation of nuclear precession phenomena is possible and very often done even without proper understanding of the underlying physics. Overhauser effect is based on the same nuclear physics phenomena, although marginally more complex and again macroscopically engineered to improve on simple proton precession effects in order to achieve much better precession signals from smaller sensors and using less power. Since the polarization of protons (generation of proton precession signal) does not require strong static magnetic fields but uses strong radio frequency magnetic field transparent to protons, measurements can be done concurrently with it. Furthermore, in the ultimate triumph of the method, one can produce a stationary, nondecaying proton precession signal, in vague similarity to alkali vapor magnetometers using simple feedback techniques. The underlying physics of the two methods are examined. Author

N90-27189# Geological Survey of Canada, Ottawa (Ontario). Geophysics Div.
SOME THOUGHTS ON DATA PROCESSING
R. L. Coles *In* Finnish Meteorological Inst., Proceedings of the International Workshop on Geomagnetic Observatory Data Acquisition and Processing 15 Feb. 1990 p 110-112 (For primary document see N90-27177 21-46)
Avail: NTIS HC A07/MF A01

The geomagnetic field is a complex phonomenon, varying on times scales ranging from fractions of a second to millions of years. It has long been a custom of geomagneticians to devise ways of simplifying and characterizing the changes in the field. The age of digital magnetometers, computers, and digital processing is now in effect. It is important to recognize that basic processing of data is outdated. The thought processes must be realigned to think in terms of already well established concepts in time series signal processing. With instrumentation such as seen at this workshop, and with concepts like INTERMAGNET, our data must be processed using modern, and correct, concepts. Some concepts are examined. Author

N90-27190# Geological Survey of Canada, Ottawa (Ontario). Geophysics Div.
INTERMAGNET
R. L. Coles, A. W. Green, Jr., Jean-Louis LeMouel, and W. F. Stuart (National Environmental Research Council, Edinburgh, Scotland) *In* Finnish Meteorological Inst., Proceedings of the International Workshop on Geomagnetic Observatory Data Acquisition and Processing 15 Feb. 1990 p 113-116 (For primary document see N90-27177 21-46)
Avail: NTIS HC A07/MF A01

INTERMAGNET is an international real time global geomagnetic observatory network. INTERMAGNET uses the existing system of geostationary meteorological satellites to communicate data from a globally distributed set of geomagnetic observatories to downlink points world wide. The satellites (GOES-East, GOES-West, Meteosat, GMS, and INSAT) provide complete coverage of the world except for the extreme polar regions. The real time data consists of high quality, three component geomagnetic observatory data with good absolute base line control and, in some cases, activity indices. These data and indices are transmitted and received at intervals of 12 minutes and 1 hour. The need for real time geomagnetic data is examined. Author

N90-27191# Institut de Physique du Globe, Paris (France). Dept. de Geomagnetisme.
ABOUT THE DERIVATION OF GEOMAGNETIC INDICES FROM DIGITAL DATA
M. Menvielle *In* Finnish Meteorological Inst., Proceedings of the International Workshop on Geomagnetic Observatory Data Acquisition and Processing 15 Feb. 1990 p 117-126 (For primary document see N90-27177 21-46)
Avail: NTIS HC A07/MF A01

Most of the present geomagnetic indices have been designed at a time when observatories were operated using analog variometers, and their derivation scheme therefore fits with the related requirements. They belong to the analog era. At present, more and more observatories are operated using digital magnetometers, and, in a near future, satellite remote data transmission will allow real time availability of the observations. Then the digital era will be entered, and the observatory routines should evolve accordingly. Some basic points that must be taken into account when geomagnetic indices are designed for the digital era are examined. Author

N90-27192# Institut de Physique du Globe, Paris (France). Dept. de Geomagnetisme.
USE OF GEOMAGNETIC DATA FOR STUDIES ON THE EARTH'S DEEP INTERIOR Abstract Only

Jean-Louis LeMouel *In* Finnish Meteorological Inst., Proceedings of the International Workshop on Geomagnetic Observatory Data Acquisition and Processing 15 Feb. 1990 p 127 (For primary document see N90-27177 21-46)
Avail: NTIS HC A07/MF A01

The methods are described which are in use for the study of the deep interior of the Earth and the present knowledge of the conductivity profile of the mantle. Also motions of the top of the core, motions inside the core and the geodynamo, and the core-mantle coupling including the exchanges of heat and angular momentum with effects on the Earth's rotation are discussed. The importance of long time series of geomagnetic data with high absolute accuracy from different parts of the world is stressed, as well as the importance of satellite surveys. The knowledge of the geomagnetic secular variation based on observatory data is found still insufficient and needing improvement for the modeling of the conductivity of the deep mantle, the diffusion at the core-mantle boundary and the fluid velocities at the core-mantle boundary. The main field geomagnetism has reached the point where accurate global vector data extending over significant time span is required for significant advances in SEDI. Author

N90-27193# Academy of Sciences (USSR), Troitsk. Inst. of Terrestrial Magnetism.
USE OF THE METHOD OF NATURAL ORTHOGONAL COMPONENTS FOR DERIVATION OF S SUB R-VARIATION AND DIGITAL K-INDICES
V. P. Golovkov, V. O. Papitashvili, and N. E. Papitashvili (Soviet Geophysical Committee, Moscow, USSR) *In* Finnish Meteorological Inst., Proceedings of the International Workshop on Geomagnetic Observatory Data Acquisition and Processing 15 Feb. 1990 p 128-135 (For primary document see N90-27177 21-46)
Avail: NTIS HC A07/MF A01

The possibilities of applying the Method of Natural Orthogonal Components to derive the Sr-variation, changing from day to day, are considered. It is necessary to derive the S sub R-variation for the K-index calculation at magnetic observatories producing digital geomagnetic data. The proposed technique has sufficient accuracy and it is very close to the hand scaled determination of S sub R by an experienced observer. Author

N90-27194# Finnish Meteorological Inst., Helsinki. Dept. of Geophysics.
COMPUTER PRODUCTION OF K-INDICES BY A SIMPLE METHOD BASED ON LINEAR ELIMINATION
Risto Pirjola, Jouni Ryno, and Christian Sucksdorff *In its* Proceedings of the International Workshop on Geomagnetic Observatory Data Acquisition and Processing 15 Feb. 1990 p 136-146 (For primary document see N90-27177 21-46)
Avail: NTIS HC A07/MF A01

A hybrid method is presented for computer production of geomagnetic K-indices. The simple maximum-minimum method and the use of linearly eliminated data is examined. In the linear elimination, a linear least square fit is calculated for each hour + or - 45 minutes using digital magnetic data, and the fit is subtracted from the data of the particular hour. After this elimination the 3 h K-indices are determined using the K-limits of the observatory in question. K-values obtained from the linearly eliminated data smaller than or = to 2 are accepted as final, and if K is larger than 2, the final index is determined from the original data without any elimination (maximum-minimum). At a high latitude observatory, the method seems to give an agreement better than 80 percent with hand scaled values and only very few indices differ by more than 1. At middle latitudes, complete agreement is about 75 percent, and at low latitudes about 60 percent. In all cases, differences greater than 1 occur seldom. Author

N90-27195# Los Alamos National Lab., NM.
CROSSED-MICROWAVE-BEAM AIR IONIZATION LABORATORY EXPERIMENTS
W. T. Armstrong, R. Karl, M. Kelly, R. Roussel-Dupre, M. Buchwald, C. D. Sutherland, J. Zinn, R. Alvarez, P. Bolton, and G. Sieger et al 1990 12 p Presented at the AGARD Electromagnetic Wave Propagation Panel Symposium on Ionospheric Models and its Potential to Enhance or Degrade the Performance of Military Systems, Norway, May 1990 Prepared in cooperation with AFGL, Hanscom AFB, MA, SRI International Corp., Menlo Park, CA, and EG and G Energy Measurements, Inc., Los Alamos, NM
(Contract W-7405-eng-36)
(DE90-012056; LA-UR-90-1787; CONF-9005208-1) Avail: NTIS HC A03/MF A01

Detailed laboratory measurements and theoretical modeling relevant to the production, geometrical description and decay of microwave-induced air ionization for an upper atmospheric RF reflecting layer are reported. It is found that breakdown thresholds are adequately predicted by fluid models and simplified scaling models with refinement by kinetic models being important at lower pressures. Repetitive pulse sustainment has been demonstrated to be straightforward with a commensurate reduction in sustainment power levels. However, establishment of a convenient breakdown geometry for specular RF reflections, other than a single layer in a crossed beam geometry, was not obtained. Detailed density decay measurements qualitatively support estimates of decay times and indicate ionization dwell times of tens of milliseconds. Chemistry studies indicate three N(sub x)O(sub x) species will be produced. Further study of these collateral reactions is required to establish whether adverse atmospheric consequences can result. However, large N(sub x)O(sub x) production does not appear as a concern for relatively small, low repetition rate, proof of concept atmospheric experiments. A realizable proof of concept experiment is found with simple optimization criteria which is corroborated by laboratory measurements and theoretical simulations. Tail-erosion appears as a potentially severe limitation in atmospheric experiments beyond the proof of concept level, suggesting use of multiple-beam systems. DOE

N90-27196# State Univ. of New York, Stony Brook.
GEOCHEMISTRY AND ORIGIN OF REGIONAL DOLOMITES
Annual Progress Report, 26 Jul. 1986 - 31 Dec. 1989
G. N. Hanson and W. J. Meyers Dec. 1989 88 p
(Contract DE-FG02-85ER-13416)
(DE90-012589; DOE/ER-13416/5) Avail: NTIS HC A05/MF A01

The major goal of the carbonate research program at Stony Brook is to better understand the conditions and processes leading to regional diagenesis of carbonate rocks. Our research focuses on studies of ancient, massive dolostones, but we are also studying limestone diagenesis for its own importance, and as it relates to dolomitization. Our approach has been to carry out a very detailed petrographic and geochemical case study to the Mississippian Burlington-Keokuk Fms. of Iowa, Illinois and Missouri, and to develop this as a testing ground for new geochemical and modelling techniques, and for testing various models for regional dolomitization in epicontinental carbonates. The ideas and techniques developed in our Burlington-Keokuk studies are being expanded and applied to carbonate sequences of other ages (Devonian to Neogene), and other tectono-sedimentary settings. The emphasis of this report will be on new developments and results on the Burlington-Keokuk studies and on our diagenetic studies of other strata. Recent research on Burlington-Keokuk rocks include development and application of boron isotopes and the U--Th--Pb system to dolomite studies, investigations of porosity and permeability in the dolostones. Projects on other strata include dolomitization and limestones diagenesis of Devonian carbonates of Alberta and Western Australia, Miocene reefal carbonates of Spain, Neogene carbonates of Curacao and Bonaire, Waulsortian limestones of Ireland, modelling of trace elements and stable isotopes, and experimental growth of calcites to investigate crystallographic controls of trace element incorporation. DOE

N90-27197# Naval Postgraduate School, Monterey, CA. Dept. of Meteorology.
CLOUD REFLECTANCE CHARACTERISTICS IN THE PRESENCE OF VARIABLE DIMETHYLSULFIDE (DMS)

SOURCES M.S. Thesis
Greg A. Eisman Sep. 1989 52 p
(AD-A222806) Avail: NTIS HC A04/MF A01 CSCL 04/1

Oceanic dimethylsulfide (DMS) sources are inferred from silicon anomaly information in the Denmark Strait during June 1984. This June 1984 bloom of the phytoplankton species Phaecystes pouchetti, a known DMS producer, is compared to the non-bloom of June 1982 using NOAA-7 Advance Very High Resolution Radiometer (AVHRR) data from channel 1 (.63 microns), channel 3 (3.7 microns) and channel 4 (11.0 microns) wavelengths. After examining the AVHRR color-enhanced data for each individual day, composites for June 1982 and June 1984 are created for channel 1 and channel 3 wavelengths. These composites eliminated day-to-day differences in reflectances by averaging data which were neither cloud-free nor high-cloud contaminated. Based on these composites, evidence is presented which suggests that a correlation exists between inferred-DMS source regions and higher reflectance values at channel 3 wavelengths. GRA

N90-27198# University Coll. of Wales, Aberystwyth. Dept. of Physics.
AMPLITUDE AND PHASE SCINTILLATION AND IONOSPHERIC IRREGULARITIES AT SUB-AURORAL LATITUDES Interim Report, 30 Sep. 1987 - 31 Mar. 1989
L. Kersley, S. E. Pryse, and C. D. Russell 31 Mar. 1989 39 p
(Grant AF-AFOSR-0378-87)
(AD-A222861) Avail: NTIS HC A03/MF A01 CSCL 04/1

Intensity and phase scintillation was studied by monitoring transmissions from NNSS satellites at Lerwick, a sub-auroral location in northern UK. Observations commenced in July 1987 and the first part concentrates on an analysis of scintillation occurrence morphology during the first ten months of the investigation. A discrete region of irregularities close to the boundary is implied from the observations while the absence of a significant geometrical enhancement about the geomagnetic field position suggests that the irregularities close to the boundary may have small axial ratios. A comparative study was made of the scintillation boundary for irregularities of sub-kilometer scale and the boundary of less than 30 m scale irregularities causing auroral backscatter of HF radar signals. In general the scintillation boundary was found to be some 7 to 8 deg polewards of that detected by the radar. In a reanalysis of the data a reconciliation could be made to get agreement in only about half of cases studied. Author

N90-27199# Air Force Systems Command, Wright-Patterson AFB, OH. Foreign Technology Div.
GEOLOGIC INTERPRETATION OF GRAVITY ANOMALIES
B. A. Andreyev and I. G. Klushin 19 Apr. 1990 902 p Transl. into ENGLISH of Geologicheskoye Istolkovaniye Gravitatsionnykh Anomaliy (Leningrad, USSR, Nedra), 1965 p 1-495
(AD-A222910; FTD-ID(RS)T-0202-88) Avail: NTIS HC A99/MF E06 CSCL 08/7

A sufficiently complete and systematic illumination is provided of physico-geologic and mathematical aspect of complex problem of interpretation of gravity anomalies. The rational methods of localization of anomalies are examined in detail. All methods of interpreting gravity anomalies are described which have found successful application in practice. Also given are ideas of some new methods of the interpretation of gravity anomalies, the prospects for further development and industrial testing. Numerous practical examples to interpretation are given. Partial Contents: Bases of gravitational field theory; Physico-geologic bases of gravitational prospecting; Principles of geologic interpretation of gravity anomalies; Conversions and calculations of anomalies; Interpretation of gravity anomalies for bodies of correct geometric form and for bodies of arbitrary form; Geologic interpretation of the results of regional gravitational photographing; Searches and prospecting of oil- and gas-bearing structures and of deposits of ore and nonmetalliferous useful minerals. GRA

N90-27200# California Univ., Santa Barbara. Marine Science Inst.
EVOLUTION OF OVERLAPPING SPREADING CENTERS: A SEAMARC 2 INVESTIGATION Final Report
Ken C. MacDonald and P. J. Fox (Rhode Island Univ., Narragansett.) 7 Jun. 1990 12 p
(Contract N00014-89-J-1029)
(AD-A223102) Avail: NTIS HC A03/MF A01 CSCL 08/7

During a major SeaMARC 2 expedition in May to June 1987 we mapped all the overlapping spreading centers (OSCs) north of the equator, between 8 and 18 deg N, and all their related off-axis scars. With this areal coverage of sidescan sonar and bathymetric data we document the current status and the evolutionary path of these discordant zones over the last one million years. The collection of this coverage high resolution sonar data allows us to characterize zones of normal and anomalous bottom roughness, which can be related to the near-axis geological processes which created them. We have completed the following tasks: (1) complete analysis of tectonic and magnetic data for the 11 deg 45'N survey (11 deg 20'N to 12 deg 30'N); (2) the nature of faulting on mid-ocean ridges based primarily on SeaMARC 2 data from our ONR cruise; (3) creation of final 50 m contour interval maps for 8 -18 deg N merging SeaMARC 2 data with existing Sea Beam data. Also included is a reprint entitled The Mid-Ocean Ridge. GRA

N90-27201# Ohio State Univ., Columbus. Dept. of Geodetic Science and Surveying.
THE ROLE OF THE TOPOGRAPHY IN GRAVITY GRADIOMETER REDUCTIONS AND IN THE SOLUTION OF THE GEODETIC BOUNDARY VALUE PROBLEM USING ANALYTICAL DOWNWARD CONTINUATION Final Report, 1 Apr. 1986 - 30 Sep. 1989
Yan Ming Wang Sep. 1989 55 p
(Contract F19628-86-K-0016; AF Proj. 7600)
(AD-A223107; OSU/DGSS-RF-765306/718188; GL-TR-90-0001)
Avail: NTIS HC A04/MF A01 CSCL 08/5

The effect of topography on gravity gradient data is considered and the effect of topography on the solution of the geodetic boundary value problem by using analytical downward continuation is also investigated. The validity of solving Molodensky's problem by using the analytical downward continuation is inspected. Even though it has been shown that the analytical downward continuation solution is equivalent to Molodensky's solution which is considered theoretically perfect, a very small topographic effect exists. This effect is trivial and can be neglected in the numerical computations. It is also shown that a spherical harmonic expansion cannot exactly represent the disturbing potential outside the Brillouin sphere and nearby the earth at the same time. If the points are nearby the earth (between the Brillouin sphere and the earth's surface), there is a topographic effect to the geopotential represented by a spherical harmonic expansion whose coefficients are determined by using the gravity anomalies analytically downward continued onto the ellipsoid. This effect is the same as the solving of the Molodensky's problem by using the analytical downward continuation. The convergence problem of the analytical downward continuation is also investigated under planar approximation. It is shown that the downward continuation is convergent almost everywhere, except at the infinite point of the circular frequency omega = infinity. This is important for geopotential modeling. GRA

N90-27202# Pacific-Sierra Research Corp., Los Angeles, CA.
IONOSPHERIC HEATING WITH OBLIQUE WAVES. VOLUME 2: APPLICATIONS TO HIGH-FREQUENCY RADIO PROPAGATION Scientific Report No. 2, 13 Feb. 1987 - 31 Jul. 1989
R. M. Bloom and E. C. Field, Jr. 1 Aug. 1989 46 p
(Contract F19628-87-C-0028; AF Proj. 2310)
(AD-A223111; PSR-1864-Vol-2; AFGL-TR-89-0311) Avail: NTIS HC A03/MF A01 CSCL 04/1

This volume presents numerical calculations of ionospheric electron density perturbations and ground-level signal changes for several electric field distributions produced by high-frequency (HF)

transmitters. This volume applies theory developed in earlier work (Vol. 1) to the problem of possible self-effects of powerful obliquely incident radio waves. Using the results from this earlier work, we use field-driven changes in ionospheric electron density to calculate modified ambient refractive index profiles and the consequent effects on ground signal intensity for sample transmitters. Our calculations indicate that ground-level field-intensity changes of several dB might be produced by joule-heating of the ionosphere by intense oblique HF waves. Our results are extremely sensitive to the model ionosphere and therefore indicate that an experiment should employ the widest possible range of frequencies and propagation conditions. GRA

N90-27203# Texas Univ., Dallas. Center for Space Sciences.
ELECTRODYNAMICS OF THE HIGH LATITUDE IONOSPHERE Final Report, Sep. 1986 - Sep. 1989
R. A. Heelis Feb. 1990 33 p
(Contract F19628-86-K-0042; AF Proj. 2310)
(AD-A223229; GL-TR-90-0027) Avail: NTIS HC A03/MF A01 CSCL 04/1

Both large and small scale structure in the plasma density and velocity are important phenomena to be understood in the ionosphere. The ability to characterize the high-latitude plasma motion over large spatial scales is demonstrated here with the development of a model that can be driven by data inputs. The model can also be used to study the mechanisms producing large scale structures in the plasma. The applicability of the model is demonstrated for periods when the interplanetary magnetic field (IMF) has a southward component. During periods of northward IMF the electrodynamics of the ionosphere on spatial scales of 100 km must be understood. Here the combination of ground based and space based data are invaluable tools. We show that mesoscale features may be coherent over many hours and constitute an important signature of the interaction of the Earth's magnetic field with the interplanetary medium. GRA

N90-27204# Photometrics, Inc., Woburn, MA.
PROGRAM TO PERFORM RESEARCH ON USE OF LIDAR FOR RANGE RESOLVED TURBULENCE MEASUREMENTS Final Technical Report, 23 Sep. 1988 - 30 Oct. 1989
Warren P. Moskowitz and Richard C. Garner 30 Nov. 1989 41 p
(Contract F19628-88-C-0150)
(AD-A222189; PHM-TR-89-10; GL-TR-89-0316) Avail: NTIS HC A03/MF A01 CSCL 17/5

The design of a lidar system capable of measuring remotely range resolved atmospheric turbulence is presented. The connection between the measured quantities and the accepted turbulence strength parameter (C sub n)-sq is developed theoretically. Simulations of an operating system were made, and the results provide a measure of system capability. A typical value for (C sub n)-sq of 10(exp -16) m to the -2/3 power at 3 km vertical range is measurable with a 200 m range resolution. GRA

N90-27205# New York Univ., New York. Magneto-Fluid Dynamics Div.
ANALYTICAL STUDIES OF MAGNETOSPHERIC PULSATIONS Final Report, 1 Jul. 1986 - 31 Dec. 1989
Elie Hameiri Feb. 1990 9 p Submitted for publication
(Grant AF-AFOSR-0167-86; AF Proj. 2311)
(AD-A222275; AFOSR-90-0600TR) Avail: NTIS HC A02/MF A01 CSCL 20/9

The research carried out may be divided into four main areas, each involving a number of sub-projects. The main areas are: (1) Magnetohydrodynamic theory of magnetospheric micropulsations, (2) Kinetic magnetospheric waves, (3) Ballooning modes in the geo-magnetospheric; and (4) Development of a general theory of ballooning modes. The work has resulted in 10 articles listed at the end of the report. GRA

N90-27206# McDonnell-Douglas Space Systems Co., Huntington Beach, CA. Design and Technology Center.
THE NEAR-EARTH ORBITAL ENVIRONMENT COUPLING TO ITS ENERGY SOURCES Final Report, 1 Mar. 1987 - 28 Feb. 1990
William P. Olsen, S. L. Huston, K. A. Pfitzer, and T. S. Mogstad 21 May 1990 79 p
(Contract F49620-87-C-0039)
(AD-A222435; AFOSR-90-0658TR) Avail: NTIS HC A05/MF A01 CSCL 20/9

Under the present study the qualitative work performed earlier has been extended to perform quantitative calculations of the entry of plasma into the magnetosphere. These calculations include the structure of the low-latitude boundary layer and the energy spectrum of the particles within the plasma sheet. These calculations were performed using actual satellite data and virtually no assumed parameters. The success of these calculations provides impressive evidence for the validity of the Gradient Drift Entry theory. It also proves that the widely held notion that the magnetosheath cannot be the source of plasma sheet particles is in error. The success of this study permits the development of quantitative models of the magnetosphere required for the prediction of magnetospheric and upper atmospheric and ionospheric effects on those hardware systems which must operate in Earth orbital space. GRA

N90-27207# SRI International Corp., Menlo Park, CA.
OBSERVATIONS OF PLASMA STRUCTURE FREEZING SCALE AT EQUATORIAL LATITUDES Technical Report, 1 Jul. 1987 - 31 Dec. 1988
R. C. Livingston and J. F. Vickrey May 1990 52 p
(Contract DNA001-86-C-0002)
(AD-A222529; DNA-TR-89-137) Avail: NTIS HC A04/MF A01 CSCL 04/1

The spectral characteristics of equatorial ionospheric F region structure was experimentally studied. This investigation has included rf propagation measurements as well as in-situ satellite and rocket observations scanning both vertically and horizontally across the magnetic field. Provided that care is taken to avoid strong scatter effects in the propagation data, all of the techniques provide a similar characterization of the plasma concentration fluctuation spectrum-a two-component power law form. The agreement between the horizontal and vertical scans indicates isotropy of the plasma irregularities in the plane perpendicular to the magnetic field. The freezing scale, which was identified with the break or change of slope of the power spectrum, moves to larger scale sizes with increasing altitude. The dependence of this behavior is well matched by the inverse of the ion-neutral collision frequency. GRA

N90-27208# Naval Ocean Systems Center, San Diego, CA. Tropospheric Branch.
RADIO REFRACTIVITY PROFILES DEDUCED FROM LIDAR MEASUREMENTS Final Report, FY 1989-1990
M. R. Paulson and H. G. Hughes Jan. 1990 38 p
(AD-A221727; NOSC/TD-1752) Avail: NTIS HC A03/MF A01 CSCL 04/1

Measurements are presented of the returns from a vertically pointing lidar, along with simultaneous radiosonde measurements of meteorological parameters on 13 cloud-free days near the ocean at San Diego, California. Linear regression analyses between the lidar range-compensated power, S(R), and the relative humidity, RH, gave high coefficients of correlation for individual days, but the magnitudes of the regression constants differed from day to day, indicating differing properties of the aerosols for each day. The combined data set was used to derive a linear relationship between S(R) at different altitudes and the corresponding values of RH. This resulted in a correlation coefficient of 0.73. Using standard vertical lapse rates of temperature and pressure with the profiles of relative humidity determined from the lidar returns, the modified radio refractivity (M-units) variations with altitude were determined for each of the days. These M-unit profiles were then compared to the corresponding values calculated from the radiosonde data. While the absolute values differed with altitude

in most cases, the gradients in M-units with altitude corresponded remarkably well. Using a ray-trace computer program, two-dimensional (altitude-versus-range) plots of the radio signal coverage were determined by using the M-unit profiles determined by the two methods. The plots in both cases show similar ducting conditions. GRA

N90-27209# Air Force Geophysics Lab., Hanscom AFB, MA. Atmospheric Sciences Div.
AN OUTLINE FOR THE RTNEPH INFRARED ATMOSPHERIC WATER VAPOR ATTENUATION STUDY Environmental Research Papers
Robert P. DEntremont, John-Luc Moncet, Todd R. Miller (Atmospheric and Environmental Research, Inc., Cambridge, MA.), Michael K. Griffin, Larry W. Thomason, James T. Bunting, and Crystal Barker Schaaf 29 Dec. 1989 45 p
(AF Proj. 6670)
(AD-A221753; GL-TR-89-0344; GL-ERP-1050) Avail: NTIS HC A03/MF A01 CSCL 04/1

The Real-Time Nephanalysis (RTNEPH) generates real-time global analysis of cloud extent, base, height, and type. The RTNEPH makes extensive use of satellite data that are measured in the 10 to 12 micron infrared (IR) window for thermal mapping of clouds and the earth's surface both day and night. Water vapor absorption effects are significant in such data, especially for high viewing angles and tropical atmospheres where water vapor concentrations are generally high. Water vapor attenuates the emitted ground radiance, reducing its magnitude and with it the apparent temperature of the surface being viewed. Currently, the RTNEPH takes into account such attenuation losses using lookup tables that are functions of viewing geometry, time of day, type of background, and the like. However, these corrections have limited value and leave room for significant improvement. This report outlines and presents two new techniques that are expected to enhance the attenuation correction capabilities of the RTNEPH, multivariate polynomial regression (the Weinreb technique) and the correlated K method. GRA

N90-27210# RADEX, Inc., Bedford, MA.
EVALUATION OF MAGNETOSPHERIC INTERNAL MAGNETIC FIELD MODELS AND EXISTING SOFTWARE Scientific Report No. 3, Jun. 1989 - Jan. 1990
C. E. Jordon and J. N. Bass 31 Jan. 1990 80 p
(Contract F19628-89-C-0068; AF Proj. 7659)
(AD-A221816; RX-R-90012; GL-TR-90-0014) Avail: NTIS HC A05/MF A01 CSCL 20/3

In preparation for analysis of the CRRES databases (to be taken from 1990 to 1995) and, in particular, for an updated static radiation belt model, a comparison has been made of four magnetospheric internal magnetic field models. Since there is interest in radiation belt models out to geosynchronous altitudes, it will be necessary to consider the external magnetic field models as well, but for now just the internal models will be discussed. The four models reviewed here are Barraclough, MAGSAT, IGRF 1985, and Cain. Each of these has an optimal time period associated with it: Barraclough 1975, MAGSAT 1980, IGRF 1985, and Cain 1990. In the subsequent sections of this report, the derviations of these models will be summarized. They are all based on these spherical harmonic expansion of the magnetic field's scalar potential. The data used to determine each set of coefficients will be briefly discussed. Then the models will be evaluated by comparing the magnetic field and L-shell values obtained from each of the models. Finally, various computer codes which use these models to evaluate the field and L-shell, will be compared and evaluated in terms of their performance (i.e., accuracy and speed). A primary concern for radiation belt models is reduction of the number of binning parameters by using B-L coordinates. GRA

N90-27211# Cologne Univ. (Germany, F.R.). Inst. fuer Geophysik und Meteorologie.
ON AIRBORNE MEASUREMENTS OF RADIATION FROM BROKEN CLOUD FIELDS
Franki Yuk-pui Lee 1989 113 p Sponsored by Deutscher Akademischer Austauschdienst, and Royal Observatory
(Mitt-67; ISSN-0069-5882; ETN-90-97328) Avail: NTIS HC A06/MF A01

Sampling guidances to obtain a statistically representative sample under various solar zenith angles and cloud covers for broken cloud field were developed. Anomalous cloud absorption, deviations between the horizontal and tilted measurements and relations between intermittency parameter and cloud cover were studied with a three dimensional model. The relation between the intermittency parameter and cloud cover is fitted by a regression polynomial from which the irradiance spectrum for the whole field can be estimated, once the cloud cover is known. ESA

N90-27212# Cologne Univ. (Germany, F.R.). Inst. fuer Geophysik und Meteorologie.
MEASUREMENT OF DIURNAL VARIATION IN THE EARTH RADIATION BUDGET [STICHPROBENANALYSEN DES TAGESGANGES DER PLANETAREN STRAHLUNGSBILANZ]
Martin Rieland 1989 120 p In GERMAN; ENGLISH summary
(Mitt-69; ISSN-0069-5882; ETN-90-97329) Avail: NTIS HC A06/MF A01

METEOSAT data in high temporal resolution is used to determine diurnal varitations in the Earth Radiation Budget (ERB). The inversion process, converting band limited METEOSAT measurements to unfiltered flux densities, is based on the data inversion process of the ERB. It is concluded that diurnal variations in ERB components can be interpreted as top boundary conditions of the Earth-atmosphere system, which drives and is driven by the circulation patterns of the atmosphere and the oceans. Time integration models are discussed. Series analysis of the METEOSAT fluxes and modeling of the temporal variability of clouds are suggested for further improvement of the model. ESA

N90-27148*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
DESCRIPTION OF SAFIRE FOR ISES
Jae H. Park *In its* Earth Sciences Requirements for the Information Sciences Experiment System Jul. 1990 p 89-90 (For primary document see N90-27140 21-43)
Avail: NTIS HC A10/MF A02 CSCL 04A

N90-27150*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
TROPOSPHERIC SOUNDERS
H. A. Wallio *In its* Earth Sciences Requirements for the Information Sciences Experiment System Jul. 1990 p 105-114 (For primary document see N90-27140 21-43)
Avail: NTIS HC A10/MF A02 CSCL 04A

N90-27154*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
APPLICATIONS OF ISES FOR GEOLOGY
David E. Bowker *In its* Earth Sciences Requirements for the Information Sciences Experiment System Jul. 1990 p 139-143 (For primary document see N90-27140 21-43)
Avail: NTIS HC A10/MF A02 CSCL 08G

N90-27155*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
APPLICATIONS OF ISES FOR THE ATMOSPHERIC SCIENCES
James M. Hoell, Jr. *In its* Earth Sciences Requirements for the Information Sciences Experiment System Jul. 1990 p 145-158 (For primary document see N90-27140 21-43)
Avail: NTIS HC A10/MF A02 CSCL 04A

47 METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

N90-27213# Meteorological Satellite Center, Tokyo (Japan).
METEOROLOGICAL SATELLITE CENTER TECHNICAL NOTE, NO. 17, 1988
Nov. 1988 122 p In ENGLISH and JAPANESE Original contains color illustrations
(ISSN-0388-9653) Avail: NTIS HC A06/MF A01

Results of analyses of data from the Geostationary Meteorological Satellite and the Meteosat satellite are discussed. Dust storms in east Asia, Australia, and Africa; distribution of forest fire smoke in China; determination of the position accuracy of typhoon centers; an automatic method for calculating high level winds; nephanalysis; pre-typhoon active convective clouds; and satellite cloud information charts are among the topics covered. For individual titles, see N90-27214 through N90-27223.

N90-27214# Meteorological Satellite Center, Tokyo (Japan).
DUST CLOUDS KOSA FROM THE EAST ASIAN DUST STORMS IN 1982-1988 AS OBSERVED BY THE GMS SATELLITE
N. Murayama *In its* Meteorological Satellite Center Technical Note, No. 17, 1988 Nov. 1988 p 1-8 (For primary document see N90-27213 21-47)
Avail: NTIS HC A06/MF A01

In order to examine how often dust storms in east Asia and the resultant dust clouds, Kosa, occur and can be observed by the geostationary meteorological satellite, the Geostationary Meteorological Satellite (GMS) visible and infrared images were surveyed for the period of 1982 to 1988. Twenty one cases were presented in which about a half of the duststorms were identified in the infrared images in cloud-free areas. Steaky features of the dust storms mostly at early stages and their subsequent change to fuzzy patches, possibly in the mature or decaying stage which are identical to so-called dust clouds, were useful in identifying the dust storms in their sources area in the satellite images. Some of the dust clouds reported in a synoptic observation in Japan, though they were minor storms, were not identified in the GMS images. The phenomenologically significant dust clouds, Kosa, on their transport route were identified up to the distance of about 3000 km and more, far from the sources with transversal extent of about 500 to 1500 km over Japan Islands and the vicinity. The average transport speed was 40 km/h (15m /s). Synoptic weather condition clearly governs the behavior of the dust clouds, which is discussed for each of the cases. Author

N90-27215# Meteorological Satellite Center, Tokyo (Japan). System Engineering Div.
REPRODUCTION OF GMS IR CALIBRATION TABLE c43
Hideyuki Sasaki *In its* Meteorological Satellite Center Technical Note, No. 17, 1988 Nov. 1988 p 9-13 (For primary document see N90-27213 21-47)
Avail: NTIS HC A06/MF A01

Geostationary Meteorological Satellite (GNS) series satellites have a function of preparing individual IR calibration tables for every image. But before February 1987, an operational calibration table was derived from daily mean calibration data and it was updated once a day. It means that the same table was used for eight images which were taken from 06GMT to the next 03GMT. If any diurnal change or random fluctuation occurs in IR sensor, brightness temperatures derived from daily mean calibration table are unsuitable, because such change or fluctuation are directly reflected on IR count levels. The results of the reproduction of IR calibration tables for all images from July 1983 through February 1987 are given. Author

N90-27216# Meteorological Satellite Center, Tokyo (Japan).
DISTRIBUTION AND MOVEMENT OF SMOKES FROM FOREST FIRES THAT OCCURRED ALONG THE BOUNDARY OF THE PEOPLE'S REPUBLIC OF CHINA AND THE USSR ON APRIL-MAY 1987 c45
Tadashi Aso and Seiichiro Kigawa *In its* Meteorological Satellite Center Technical Note, No. 17, 1988 Nov. 1988 p 15-29 In JAPANESE; ENGLISH summary Original contains color illustrations (For primary document see N90-27213 21-47)
Avail: NTIS HC A06/MF A01

Big forest fires occurred along the boundary of the People's Republic of China and the USSR on April-May 1987. Distribution and movement of smoke from the forest fires can be detected in Geostationary Meteorological Satellite (GMS) visible imagery, but hardly in the infrared imagery. Smoke spread over the Sea of Japan and the northwestern Pacific Ocean. Smoke moved several thousand Kilometers from the source and yet had a considerable particle density to be detected in the visible imagery. A numerical simulation by the Global Tracer Model was carried out to confirm that the observed grey area can be regarded as the smoke from the forest fires. A simulated horizontal distribution agrees quite well with the observed area over the continent, the Sea of Japan and the Pacific Ocean. An increment of albedo due to the existence of smoke particles is 0.01 to approximately 0.09 over the sea. Movement of smoke particles is greatly influenced by a synoptical disturbance. Height of smoke advection is high in front of a front, and low behind a front. The height difference indicates that the advection height of smoke particles is determined not by the updraft over the forest fires, but by the ascending and descending current of synoptical disturbance. Author

N90-27217# Meteorological Satellite Center, Tokyo (Japan).
INVESTIGATION INTO POSITION ACCURACY OF TYPHOON CENTER DETERMINED ON GMS IMAGERY
Takashi Ichinari *In its* Meteorological Satellite Center Technical Note, No. 17, 1988 Nov. 1988 p 31-44 In JAPANESE; ENGLISH summary (For primary document see N90-27213 21-47)
Avail: NTIS HC A06/MF A01

Information on the typhoon obtained from Geostationary Meteorological Satellite (GMS) imagery in the code of SAREP (WMO international code FM-85VI) since 1st June 1984 is discussed. In SAREP, position of typhoon center (hereafter GMS-center) and its accuracy, which is determined from 10 cloud patterns of typhoon, are included. The diameters of the area where typhoon centers possibly exist were newly obtained for a term of a year (1987, T8702-T8723). The diameters were verified by the difference between GMS-center and best tracks, and were in approximate agreement with the position accuracy reported in SAREP. The diameter can represent position accuracy more properly than the current determination. Author

N90-27218# Meteorological Satellite Center, Tokyo (Japan).
APPLICATION OF AUTOMATIC METHOD TO ESTIMATING HIGH-LEVEL CLOUD MOTION WIND IN OPERATIONAL SYSTEM AND THE CHARACTERISTICS OF THE RESULTANT WIND VECTORS
Takashi Ohshima *In its* Meteorological Satellite Center Technical Note, No. 17, 1988 Nov. 1988 p 45-62 In JAPANESE; ENGLISH summary (For primary document see N90-27213 21-47)
Avail: NTIS HC A06/MF A01

In order to apply the automatic method for calculating the high-level cloud motion winds to the operational system at the Meteorological Satellite Center (MSC), the improvement of the algorithm for calculating the high-level wind was carried out, and the characteristics of the resultant winds derived automatically were investigated. To calculate the high-level wind automatically, an Automatic target cloud Selection (AS) method was used to select the target of the high-level cloud, and a cross-correlation technique was used to track the moving cloud target. This method is used to calculate the low-level wind operationally, and was applied to calculate the high-level wind by modifying the algorithm and the parameter for the cirrus level cloud target. The high-level winds from the automatic method were compared with those from Loop-Film (LF) method in order to investigate the characteristics of the automatic calculated wind. The tracked winds from the cross-correlation technique had almost the same characteristics as those from the LF method, though there were a few cases in

which the cloud motion wind was not calculated when the target cloud moved very fast, especially in the middle latitude. The horizontal density of the AS winds was more than that of the LF winds. The mean vector difference between the AS winds and the radiosonde winds was a little bigger than that between LF winds and the radiosonde winds, because the AS winds were compared without rejecting erroneous winds by an analyst. It was found that the automatic method could be used routinely. MSC adopted the automatic method in place of the LF method from March 1, 1987, and this method has been used operationally in combination with man-machine interactive method on an image processing console. The resultant high-level winds have increased in number by about 30 percent since then. Author

N90-27219# Meteorological Satellite Center, Tokyo (Japan).
THE TEST FOR AUTOMATIC NEPH-ANALYSIS CHART
Shingo Osano and Masakatu Ishikawa *In its* Meteorological Satellite Center Technical Note, No. 17, 1988 Nov. 1988 p 63-72 In JAPANESE; ENGLISH summary (For primary document see N90-27213 21-47)
Avail: NTIS HC A06/MF A01

Meteorologists analyzed satellite images with various meteorological data and make neph-analysis charts consisted with cloud area by means of outlines. To make an automatic neph-analysis chart, a prototype program was made and compared with subjective neph-analysis charts. Cloud area was just associated with meteorological disturbance and consisted of very dense clouds. The outline of cloud area was considerably smoothed. Author

N90-27220# Meteorological Satellite Center, Tokyo (Japan).
CASE STUDY ON PRE-TYPHOON ACTIVE CONVECTIVE CLOUDS (PTACC)
Tomoyuki Harada *In its* Meteorological Satellite Center Technical Note, No. 17, 1988 Nov. 1988 p 73-84 In JAPANESE; ENGLISH summary (For primary document see N90-27213 21-47)
Avail: NTIS HC A06/MF A01

Active convective clouds, or cumulonimbus (Cb) clouds, were often observed at several hundred Km northeast of a typhoon. In case of T8705 (Typhoon THELMA in 1987) that was moving northward to the westery zone, several Cb clouds came into existence as much as 1000 Km away from T8705 and formed into the spiral cloud band moving north-northeastward. Research named this band-shaped cloud area consisting of Cb clouds Pre-Typhoon Active Convective Clouds (PTACC). The characteristics of PTACC are as follows: (1) Position of each Cb cloud with respect to the pressure center of T8705 was almost unchanged in spite of their large distance. The strong correlation was observed between the typhoon and PTACC. (2) Each Cb cloud moved north-northeastward with the typhoon and PTACC extended in the direction of the fringe winds of the typhoon. (3) The east-west convectively unstable zone was maintained for more than half a day in this unstable zone. PTACC differs from active convective clouds as mentioned in the past reports, such as the pre-hurricane squall line which appeared north or east of a typhoon, because of the developing form of PTACC and the distance between PTACC and the pressure center of the typhoon. The cause or mechanism of this PTACC has not been sufficiently clarified. Author

N90-27221# Meteorological Satellite Center, Tokyo (Japan).
BEHAVIOR OF DUST CLOUDS FROM AUSTRALIAN DUST STORMS IN 1982-1983 AS OBSERVED BY THE GMS
N. Murayama *In its* Meteorological Satellite Center Technical Note, No. 17, 1988 Nov. 1988 p 85-99 In JAPANESE; ENGLISH summary (For primary document see N90-27213 21-47)
Avail: NTIS HC A06/MF A01

Dust clouds observed by the Geostationary Meteorological Satellite (GMS) as a bright area between New Guinea and north Australia (hereafter NG dust clouds) in the spring (in the Southern Hemisphere) of 1982 were examined in relation to the great drough of Australia continent. The time serial GMS visible imageries were surveyed for the period of June 1982 to February 1983 to find out the dust storms and the dust clouds distant from its source area and their connection. It was ascertained that NG dust clouds were transported mainly along with the southeasterly trades and partially from north Australia and then stayed there in relation with convergent wind and/or calm condition forming an eddy-like and/or wave pattern. Eddy and waves can help vertical thickening of dust clouds. Westward movements of the wavy dust clouds are in about 20 km/h. Then the dust clouds extended to the west over Indonesia. A part of the dust cloud was transported to 20 N across the equator accompanied by a movement of the typhoon and also 20 S along with an incidental northeasterly wind. Author

N90-27222# Meteorological Satellite Center, Tokyo (Japan).
DUST CLOUDS FROM AFRICAN DUST STORMS IN 1986-1987 AS OBSERVED BY METEOSAT
N. Murayama *In its* Meteorological Satellite Center Technical Note, No. 17, 1988 Nov. 1988 p 101-109 In JAPANESE; ENGLISH summary (For primary document see N90-27213 21-47)
Avail: NTIS HC A06/MF A01

With an objective of accounting for an annual trend of dust storms in the arid area in Africa, mainly in Sahara desert, dust clouds originating from Africa dust storms were examined by use of the Meteosat imageries (in published form) for 1986 to 1987. Dust clouds were identified by the visible imagery over the land. The extent of the dust clouds was determined and the transport was traced. The Saharan dust storm occurs throughout the year. The movement of the Saharan dust cloud is related to the strong wind zone more than 10 m/s on 850 mb analyzed. The dust cloud is transported over the Atlantic Ocean about 2000 to 3000 kms from the western coast of the Africa throughout the year. Author

N90-27223# Japan Meteorological Agency, Tokyo.
AN EXPERIMENT TO MAKE A NEW DESIGN OF THE SATELLITE CLOUD INFORMATION CHART WITH THE COMBINATION OF VISIBLE AND INFRARED DATA OBSERVED BY THE GMS **c43**
Toshihiro Motoki *In* Meteorological Satellite Center, Meteorological Satellite Center Technical Note, No. 17, 1988 Nov. 1988 p 111-122 In JAPANESE; ENGLISH summary (For primary document see N90-27213 21-47)
Avail: NTIS HC A06/MF A01

The Satellite Cloud Information Chart (SCIC) developed by Motoki (1987) has been routinely produced in the Meteorological Satellite Center from March in 1987, and disseminated to the users for analysis of meteorological disturbances. Since the SCIC is made by the infrared data of 0.25x0.25 latitude/longitude box data processing, it is not enough to display the cloud areas, for example the fog/stratus cloud area. To improve the representation of the cloud area in the SCIC, a digital data analysis with a combination of infrared data and visible data is surveyed. Among the physical parameters routinely derived from the visible data processing of 0.25x0.25 latitude/longitude box data, mean reflectivity, minimum reflectivity and standard deviation are used together with mean TBB and partial cloud amount data derived from an infrared data processing. The results from the case study are summarized as follows, (1) there is a capability to detect the semitransparent cirriform cloud area, (2) there is a capability to detect the fog/stratus cloud area which is sometimes judged as a open area by using an infrared data only, (3) there is a capability to identify the spot of the semitransparent cloud area which is judged as a fog/stratus cloud area in the result of (2). Author

N90-27224 North Carolina State Univ., Raleigh.
BOUNDARY LAYER PARAMETERIZATION FOR USE IN A LIMITED AREA FORECAST MODEL Ph.D. Thesis
Teddy Rand Holt 1989 193 p
Avail: Univ. Microfilms Order No. DA8918100

The effects of different parameterizations of the boundary

layer on atmospheric mesoscale structure are tested in a three-dimensional limited area weather forecast model. Model simulations are performed for three model designs: 1 10-layer model with a one-layer bulk planetary boundary layer (PBL), a 16-layer model with a one-layer bulk parameterization of the surface layer but a mixing length PBL parameterization, and a 16-layer model with a surface energy budget, Monin-Obukhov similarity layer and a PBL parameterization based on turbulent kinetic energy (TKE) closure. Model simulations are compared to high resolution Genesis of Atlantic Lows Experiment (GALE) data for the period 25-26 January 1986 in which coastal frontogenesis and cyclogenesis were prominent. Results can be summarized as follows: (1) For mean and turbulence mesoscale structure in areas of more complex atmospheric processes, the improved TKE boundary layer parameterization provides more accurate as well as physically realistic forecasts. (2) An increase in boundary later resolution does not provide substantial improvement if turbulent boundary layer processes are not properly accounted for in the PBL parameterization. (3) For this one case study, the simple 10-layer constant depth bulk PBL model does surprisingly well in forecasting mesoscale structure. (4) Skill scores indicate little sensitivity in the larger mesoscale structure to changes in PBL parameterization. (5) Sensitivity tests to surface latent and sensible heat fluxes emphasize their importance in the development of the coastal front system. (6) From the stand point of operational forecasts on the regional scale, the simple 10-layer with a bulk PBL is quite effective, requiring only 56 percent of the CPU time required by the 16-layer mixing length model and only 49 percent of the time for the 16-layer TKE model. Dissert. Abstr.

N90-27225*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.

DOWNWELLED LONGWAVE SURFACE IRRADIANCE DATA FROM FIVE SITES FOR THE FIRE/SRB WISCONSIN EXPERIMENT FROM OCTOBER 12 THROUGH NOVEMBER 2, 1986

Charles H. Whitlock, Stephen K. Cox, and Stuart R. LeCroy (Lockheed Engineering and Sciences Co., Hampton, VA.) Mar. 1990 190 p

(NASA-TM-102597; NAS 1.15:102597) Avail: NTIS HC A09/MF A01 CSCL 04B

Tables are presented which show data from five sites in the First ISCCP (International Satellite Cloud Climatology Project) Regional Experiment (FIRE)/Surface Radiation Budget (SRB) Wisconsin experiment regional from October 12 through November 2, 1986. A discussion of intercomparison results is also included. The field experiment was conducted for the purposes of both intensive cirrus-cloud measurements and SRB algorithm validation activities. Author

N90-27226# National Inst. of Standards and Technology, Gaithersburg, MD.

PROCEEDINGS OF THE 21ST JOINT MEETING OF THE US-JAPAN COOPERATIVE PROGRAM IN NATURAL RESOURCES PANEL WIND AND SEISMIC EFFECTS

Noel J. Raufaste, ed. Jan. 1990 411 p Meeting held in Tsukuba, Japan, 16-19 May 1989

(PB90-186826; NIST/SP-776; LC-89-600788) Avail: NTIS HC A18/MF A03; SOD HC $20.00 as 003-003-02989-1 CSCL 04B

The proceedings of the Joint Meeting includes the program, list of members panel resolutions, task committee reports, and 33 technical papers. The papers were presented under six themes: Wind engineering; Earthquake engineering; Storm surge and tsunami; U.S.-Japan cooperative research program; Code development process and code enforcement responsibility; and Armenia earthquake. Author

N90-27227*# Wisconsin Univ., Madison. Cooperative Inst. for Meteorological Satellite Studies.

ANALYSIS OF CIRRUS OPTICAL PROPERTIES WITH DATA FROM NASA ER2 HIGH-RESOLUTION INTERFEROMETER SOUNDER (HIS) Final Report, 1 Apr. 1989 - 31 Mar. 1990

William L. Smith and Steven A. Ackerman Jun. 1990 12 p (Grant NAG1-1015)

(NASA-CR-186365; NAS 1.26:186365) Avail: NTIS HC A03/MF A01 CSCL 04B

The 8 to 13 micron spectral region is an important atmospheric window for radiometric studies of the Earth's surface and clouds. Most of the Earth-atmosphere longwave radiative loss to space occurs in this spectral region. Selective gaseous absorption in this window occurs in the 9.6 micron ozone band with the remaining absorption dominated by the water vapor continuum. Cirrus clouds have a large impact on the transmittance of this atmospheric window region; it is therefore important to understand the interaction of cirrus cloud with the radiation field for climate studies and in the interpretation of satellite radiometric measurements. The focus was to employ observations of the High-resolution Interferometer Sounder (HIS) made during First ISCCP Regional Experiment (FIRE) to improve the understanding of the radiative properties of cirrus clouds within this window region. Studies were undertaken to investigate the coupling between the microphysical properties of cirrus clouds and their spectral variation within this window region. Extensions of the HIS studies to satellite measurements, with regards to remote sensing and interpretation, were also investigated. Author

N90-27228*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, MD.

AN INTERCOMPARISON OF INTRASEASONAL VARIABILITY IN GENERAL CIRCULATION MODELS AND OBSERVATIONS

Chung-Kyu Park, David M. Straus (Maryland Univ., College Park.), Ka-Ming Lau, and Siegfried D. Schubert Aug. 1990 122 p

(NASA-TM-100764; Rept-90E02836; NAS 1.15:100764) Avail: NTIS HC A06/MF A01 CSCL 04B

Low frequency oscillations appearing in three GCM seasonal cycle integrations are compared with the analyses of the European Center for Medium Range Weather Forecasting (ECMWF). All three models have the same resolution: 4 deg latitude by 5 deg longitude, with 9 levels. The dominant phase speeds and the differential vertical structure of the heating profiles in the GCMs are in general agreement with current theory involving the positive feedback between latent heating and moist static stability. All three GCMs fail to capture the detailed evolution in the different stages of the development and decay of the oscillation. The results suggest that an improvement in the boundary layer moisture processes may be crucial for a better simulation of the oscillation. Author

N90-27229# KTAADN, Inc., Newton, MA.

EVALUATION OF CORRELATIONS BETWEEN METEOROLOGICAL MEASUREMENTS AND OBSERVATIONS OF LIGHTNING ACTIVITY USING ARTIFICIAL NEURAL SYSTEMS Final Report, 18 Jan. 1989 - 29 Dec. 1989

Donald S. Frankel, Ilya Schiller, and James S. Draper 29 Dec. 1989 35 p

(Contract F19628-89-C-0012)

(AD-A222659; KI-RR89-013; GL-TR-89-0339) Avail: NTIS HC A03/MF A01 CSCL 04/1

This report shows the feasibility of using artificial neural systems (ANS) for making predictions of cloud to ground lightning strikes. ANS designs offer some potentially useful features. ANS predictors can be incrementally trained for new levels of performance without starting programming from scratch each time the predictor is upgraded. Incremental training could proceed in the field reducing costs and delays of modifications while improving predictor accuracy by tailoring it to site conditions (i.e., topography, etc). Trained ANS provides a ready-made formula for constructing fast parallel, distributed processors. The features built up within the ANS might be analyzed for clues to the physical processes underlying the partially understood phenomenon of lightning. Comparisons are made of the performance of an ANS predictor with the state-of-the-art lightning prediction using a wind convergence based criterion described by Watson et al, 1987. GRA

N90-27230# Mesoscale Environmental Simulations and Operations, Inc., Hampton, VA.
A NUMERICAL STUDY OF THE ROLE OF MESO BETA AND MESO GAMMA SCALE VERTICAL EXCHANGE PROCESSES IN THE EVOLUTION OF UPPER TROPOSPHERIC FRONTAL SYSTEMS Final Technical Report, 1 Mar. 1985 - 28 Feb. 1990
Michael L. Kaplan 29 Apr. 1990 91 p
(Contract F49620-86-C-0044; AF Proj. 2310)
(AD-A222057; AFOSR-90-0531TR) Avail: NTIS HC A05/MF A01 CSCL 04/2

During the four year research project, several specific areas of knowledge were enhanced in the process of simulating meso-beta and meso-gamma scale frontogenesis and frontolysis. First, a new theory was developed, based on numerical simulations and mesoscale observations, of ageostrophic along-stream frontogenesis. The six-stage process explains how a stratified flow can trigger a sequence of unbalanced nonlinear adjustments which result in an along-stream frontal zone. Second, the effects of nonhydrostatic and turbulent motions on the fronts formed via the mechanism in ageostrophic along-stream frontogenesis was investigated. It was found that the turbulent covariances generated over length scales of about 5 to 10 km could drastically modify hydrostatic frontogenesis and produce substantial vertical heat and momentum fluxes particularly in dry adiabatic regions which exhibited significant magnitudes of velocity convergence. Third, it was found that both meso-beta scale hydrostatic and meso-gamma scale nonhydrostatic processes accompanying ageostrophic along-stream frontogenesis could produce significant local increases in relative vorticity equivalent to 1 to 3 times the Coriolis parameter or larger over time periods of 1 to 3 hours and tens of minutes, respectively: the former via the combined tilting and convergence of vorticity during isentropic folding and the latter via tilting and the vertical transport of vorticity during the turbulence caused by ageostrophic frontogenesis. GRA

N90-27231# Air Force Environmental Technical Applications Center, Scott AFB, IL.
A LOWTRAN7 SENSITIVITY STUDY IN THE 8-12 AND 3-5 MICRON BANDS: INCLUDES COMPARISON WITH LOWTRAN6 RESULTS
Patrick M. Condray Feb. 1990 22 p
(AD-A222094; USAFETAC/TN-90/002) Avail: NTIS HC A03/MF A01 CSCL 04/2

More than 750 runs of LOWTRAN7 were made to determine how variations in certain weather variables (absolute humidity, relative humidity, wind speed, meteorological range, and precipitation) affect computed atmospheric transmittance in the 8-12 and 3-5 micron bands. This was done by changing the value of each of these weather variables, in turn, and observing the resulting change in transmittance calculations. About 30 LOWTRAN6 runs were made for comparison with the LOWTRAN7 output. Results for the 8-12 micron band showed that absolute humidity and precipitation produce the greatest decreases in transmittance. When the desert aerosol is used in LOWTRAN7, high wind speeds can produce low transmittances due to heavy dust loading. Meteorological range only becomes a strong factor in lowering transmittances when it drops below 2 km. Relative humidity is important when using the maritime aerosol, especially when it exceeds 70 percent. GRA

N90-27232# Air Force Geophysics Lab., Hanscom AFB, MA. Atmospheric Sciences Div.
WIND FIELD DERIVATIVES OF EXTRATROPICAL CYCLONES OBSERVED BY DOPPLER RADAR Final Report
Frank H. Ruggiero 6 Nov. 1989 33 p
(AF Proj. 2781)
(AD-A222188; GL-TR-89-0304; GL-ERP-1046) Avail: NTIS HC A03/MF A01 CSCL 04/2

A technique to extract wind field derivatives and storm characteristic indices from data acquired by a single Doppler radar is described. The technique was applied to four extratropical cyclones observed in Massachusetts. Storm intensity indices that have worked well in tropical cyclones did not perform as well with the extratropical cyclones. The differences of structure between extratropical and tropical cyclones is mainly responsible for the poor performance of the indices. It is possible that when a network of Doppler radars is deployed, a comparative analysis to the wind field derivatives and their indices would provide useful forecasting information. GRA

N90-27233# Arizona Univ., Tucson. Inst. of Atmospheric Physics.
SOURCES OF CLOUD NUCLEI AND DEVELOPMENT OF REMOTE SENSING TECHNIQUES FOR CLOUD PARAMETERS Final Report
S. Twomey 1989 4 p
(Contract N00014-87-K-0505)
(AD-A222464) Avail: NTIS HC A01/MF A01 CSCL 04/2

The following technical objectives are discussed: development of remote sensing methods for determining cloud and fog parameters, using passive techniques; development and improvement of mathematical inversion procedures for remote sensing; and field and laboratory measurements of cloud nuclei. Approaches are: theoretical modelling (by radiative transfer theory) of cloud layers and discrete clouds under solar illumination in the visible and near infrared; identification therefrom of spectral features and/or differences which would enable differentiation (without direct insitu sampling) of (for example) ice clouds from water clouds, large drops from small drops, etc.; development and field utilization on a modest scale of experimental systems to verify (or disprove) these concepts suggested by the theoretical modelling; and development of relevant numerical techniques for forward and inverse problems. GRA

N90-27234# Naval Postgraduate School, Monterey, CA.
VANDENBERG BOUNDARY LAYER SURVEY (VBLS): RESULTS Final Report, Jan. - Dec. 1988
C. E. Skupniewicz, R. F. Kamada, and L. McKay Apr. 1990 345 p Sponsored by Air Force Space Div., Los Angeles, CA
(AD-A222517; NPS61-90-004) Avail: NTIS HC A15/MF A02 CSCL 04/2

The Vandenburg Boundary Layer Survey (VBLS) consisted of a set of three experiments at Vandenberg AFB, Calif. during 1988 to study characteristics of the atmospheric boundary layer over complex terrain during sea breeze conditions. This report consists of two sections. The section labelled as Results contains an analysis and interpretation of data. The Appendix section contains details of measurement techniques and a variety of charts and tables summarizing and supplementing the data set. Results indicate that characteristic surface roughness lengths range from .01 to .19 m, not accounting for large scale topography. The surface heat flux was not a strong function of location, and primarily depended on solar insolation as described by time and cloud over. The base was divided into four regions based on topography. Probabilities of boundary layer depth were examined relative to its dependence upon terrain height and slope, boundary layer stability, and inversion strength. Terrain height was most important. Large variations in boundary layer characteristics near the stratus edge were also observed. GRA

N90-27235# Control Data Corp., Minneapolis, MN. Dept. Meteorology Research.
A REGIONAL FORECASTING MODEL
William H. Jasperson and David E. Venne 15 Jan. 1990 13 p
(Contract F19628-89-C-0015; AF Proj. 6670)
(AD-A221556; GL-TR-90-0024; SR-1) Avail: NTIS HC A03/MF A01 CSCL 04/2

The objective of this three year project is to develop an expert system which can be used to make a short-range weather forecast from limited data. The expert system will not be tied to any particular station. This will be done by determining and utilizing the physical relationships between the synoptic weather and variables that affect the local weather such as terrain, geography and surface type. The first year's work included software selection, knowledge design issues, tentative class and object networks and structuring of the

expert system. The bases for these discussions and the description of progress on various pieces of the system are described in this report. GRA

N90-27236# Air Force Systems Command, Wright-Patterson AFB, OH. Foreign Technology Div.
MODERNIZATION OF PRC METEOROLOGICAL SERVICE
Minlian Chen 15 Mar. 1990 11 p Transl. into ENGLISH from Zidonghua Bolan (Peoples Republic of China), v. 1, 1989 p 11-12
(Contract F33657-88-D-2188)
(AD-A221761; FTD-ID(RS)T-1046-89) Avail: NTIS HC A03/MF A01 CSCL 04/2

The meteorological service system is a typical atmospheric information system. The timely, rapid gathering and processing of accurate meteorological information so that it can be put into service to safeguard the people and to build socialism is the sole aim of China's meteorological work. The National Weather Bureau, in its work of modernization, places great emphasis on the use of developed computer technology. GRA

N90-27237# Pennsylvania State Univ., University Park.
INTEGRATED RADIOMETRIC PROFILER FOR ATMOSPHERIC HUMIDITY AND TEMPERATURE MEASUREMENTS Final Report
Dennis W. Thomson 27 Apr. 1990 14 p
(Grant AF-AFOSR-0067-85)
(AD-A221931; AFOSR-90-0639TR) Avail: NTIS HC A02/MF A01 CSCL 04/2

A 9 channel, integrated radiometer for recording multi-frequency sky brightness temperatures from which atmospheric integrated water, and water vapor and temperature profiles may be estimated has been designed, constructed and field-tested. The radiometer includes 3 water-dependent (22.25, 23.9, 31.45 GHz) and 6 oxygen-dependent (50.5, 53.0, 53.6, 54.89, 58.64, 61.03 GHz) frequencies. The radiometer includes 4 Dicke-type subsystems of 2, 1, 3 and 3 multiplexed frequencies each. Control and signal processing functions are accomplished using 8 digital signal processors, 2 per subsystem, which are in turn controlled by an 80286-equipped host computer. The basic radiometer package, exclusive of the host computer and multichannel signal processing chassis, is about 1/2 x 1/2 x 1 m and is designed for airborne and shipboard (antenna pedestal) mounting as well as ground-based overland operation. All system, antenna pointing control, and signal processing functions are handled through the host computer. The radiometer may be readily used in combination with wind profilers, ceilometer, sodar and other measurement systems as are useful for improving the precision and spatial resolution of inverted water and temperature profiles. GRA

N90-27160*# Science and Technology Corp., Hampton, VA.
APPLICATIONS OF ISES FOR METEOROLOGY
Paul D. Try *In* NASA, Langley Research Center, Earth Sciences Requirements for the Information Sciences Experiment System Jul. 1990 p 197-211 (For primary document see N90-27140 21-43)
Avail: NTIS HC A10/MF A02 CSCL 04B

N90-27441# Aerospace Corp., Los Angeles, CA.
DMSP'S INTERACTIVE TACTICAL TERMINAL
Neal K. Baker *In* AGARD, Tactical Applications of Space Systems May 1990 4 p (For primary document see N90-27438 21-66)
Copyright Avail: NTIS HC A07/MF A01; Non-NATO Nationals requests available only from AGARD/Scientific Publications Executive

48 OCEANOGRAPHY

Includes biological, dynamic, and physical oceanography; and marine resources.

For related information see also *43 Earth Resources and Remote Sensing.*

N90-27238# Harvard Univ., Cambridge, MA. Div. of Applied Sciences.
GULFCASTING: DYNAMICAL FORECAST EXPERIMENTS FOR GULF STREAM RINGS AND MEANDERS Report, Nov. 1985 - Jun. 1986
Allan R. Robinson, Michael A. Spall, Wayne G. Leslie, Leonard J. Walstad, and Dennis J. McGillicuddy 1989 160 p
(Contracts N00014-84-C-0461; N00014-86-K-6002)
(AD-A221482; Rept-22) Avail: NTIS HC A08/MF A01 CSCL 08/3

Gulf Stream rings and meanders are among the most energetic of all oceanic mesoscale eddy and frontal phenomena. The meander and ring field evolves, propagates and interacts. Periods of relatively smooth development are interrupted by dramatic and energetic synoptical dynamic events such as ring births or coalescences with the stream and ring mergers. Such events rupture and shift frontal gradients rapidly. Forecasting the evolution of the Gulf Stream meander and ring system is the counterpart within the ocean of weather forecasting in the atmosphere. Here we report on a series of seven real-time forecast experiments for the Gulf Stream (called GULFCASTS) carried out by the Harvard ocean dynamics and modelling group. To our knowledge these represent the first systematic dynamically based real-time forecasting experiments for the Gulf Stream system. GRA

N90-27156*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, MD.
APPLICATIONS OF ISES FOR THE OCEANS
W. E. Esaias *In* NASA, Langley Research Center, Earth Sciences Requirements for the Information Sciences Experiment System Jul. 1990 p 159-163 (For primary document see N90-27140 21-43)
Avail: NTIS HC A10/MF A02 CSCL 08C

N90-27157*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
APPLICATIONS OF ISES FOR COASTAL ZONE STUDIES
D. S. Bartlett *In its* Earth Sciences Requirements for the Information Sciences Experiment System Jul. 1990 p 165-168 (For primary document see N90-27140 21-43)
Avail: NTIS HC A10/MF A02 CSCL 08C

N90-27442# Naval Observatory, Washington, DC. Office of the Oceanographer of the Navy.
TACTICAL OCEANOGRAPHY FROM SPACE: THE NEXT DECADE
Jonathan T. Malay *In* AGARD, Tactical Applications of Space Systems May 1990 5 p (For primary document see N90-27438 21-66)
Copyright Avail: NTIS HC A07/MF A01; Non-NATO Nationals requests available only from AGARD/Scientific Publications Executive

51 LIFE SCIENCES (GENERAL)

N90-27239*# National Aeronautics and Space Administration. Pasadena Office, CA.
PSEUDOMONAS DIAGNOSTIC ASSAY Patent Application
Ruth Margalit, inventor (to NASA) (Jet Propulsion Lab., California Inst. of Tech., Pasadena.) 30 Mar. 1990 10 p
(Contract NAS7-918)
(NASA-Case-NPO-17653-1-CU; NAS 1.71:NPO-17653-1-CU; US-Patent-Appl-SN-501908) Avail: NTIS HC A02/MF A01 CSCL 06C

A method for the detection of Pseudomonas bacteria is described where an Azurin-specific antibody is employed for detecting the presence of Azurin in a test sample. The detection of the presence of Azurin in the sample is a conclusive indicator of the presence of the Pseudomonas bacteria since the Azurin protein is a specific marker for this bacterial strain. NASA

N90-27240# Kings Coll., London (England). Dept. of Physics.
ACCURATE DETERMINATION OF THE COMPLEX PERMITTIVITY OF BIOLOGICAL TISSUE AT 90 GHz, 70 GHz, AND OVER A BROAD BAND AROUND 35 GHz Interim Report, Oct. 1987 - May 1988
Rodney J. Sheppard Mar. 1990 29 p Prepared for European Office of Aerospace Research and Development, London, England
(Grant AF-AFOSR-9343-87; AF Proj. 2312)
(AD-A222062; USAFSAM-TR-89-20) Avail: NTIS HC A03/MF A01 CSCL 06/7

The design of a new experimental system to measure the complex permittivity of liquids and solid tissues at 90 GHz is considered. A circuit diagram is presented, and an experimental cell (sample holder) of circular cross section is described. A numerical method which would enable alternative designs of cell to be considered, is presented. A broad-band system to measure complex permittivity around 35 GHz has been designed, and we confidently believe this equipment can be set up to cover the full bandwidth of 26 to 40 GHz. GRA

N90-27241# Pacific-Sierra Research Corp., Los Angeles, CA.
EFFECTS OF PROTRACTED IONIZING RADIATION DOSAGE ON HUMANS AND ANIMALS: A BRIEF REVIEW OF SELECTED INVESTIGATIONS Technical Report, 5 Jun. 1984 - 31 Jan. 1985
G. H. Anno and S. J. Baum 1 Jun. 1990 67 p
(Contract DNA001-84-C-0289; DA Proj. RN)
(AD-A222240; PSR-1687; DNA-TR-87-28) Avail: NTIS HC A04/MF A01 CSCL 06/7

A review of selected investigations of animal irradiation studies, radiation therapy experience, and radiation accident accounts is presented, and some acute effects of protected ionizing radiation exposure on animals and humans are discussed. Various guidelines and models, which account for biological recovery when radiation exposure is protracted over time, are compared. Biological response modifying effects of dose rate and protraction period in humans are discussed in terms of prodromal symptoms. Radiation injury and recovery in a variety of animals, based on the LD(50) endpoint, are reviewed and summarized for low and high dose rates ranging from 0.5 to about 700 R/h. Biological recovery models and guidelines are empirical and are primarily based on radiation injury accumulation is animals and gauged by the LD(50) endpoint. Further development of appropriate protracted dose models is relevant and necessary for military operations and emergency civil defense planning. GRA

N90-27242# Catholic Univ. of America, Washington, DC.
MECHANISMS OF MICROWAVE INDUCED DAMAGE IN BIOLOGIC MATERIALS Annual Report, 22 Sep. 1988 - 21 Sep. 1989
T. A. Litovitz, R. Meister, R. K. Mohr, C. J. Montrose, J. M. Mullins, R. M. Nardone, and M. Penafiel Jan. 1990 113 p
(Contract DAMD17-86-C-6260; DA Proj. 3E1-62787-A-878)
(AD-A222454) Avail: NTIS HC A06/MF A01 CSCL 06/1

This report is divided into four chapters which correspond to the four main lines of research being carried out under the contract. In brief, these are: (1) mathematical modeling studies, (2) experimental spectroscopic studies, (3) engineering design research, and (4) experimental biological studies. The research program is structured to attempt to discover the biological effects at the cell and molecular level that result from exposure to electromagnetic radiation. The main thrust is on the athermal effects of exposure to microwaves. Because recent work has suggested that significant cellular effects occur only when the microwaves are amplitude modulated, either with extremely low frequency (ELF) sinusoids or with pulses, we have hypothesized that the interaction of the microwave fields with cells must involve a demodulation or detection step. As a result, research designed to develop an understanding of the effects of direct ELF exposure becomes not only relevant, but vital. GRA

N90-27243# Harry Diamond Labs., Adelphi, MD.
BIOELECTROMAGNETIC EFFECTS OF THE ELECTROMAGNETIC PULSE (EMP)
Eugene L. Patrick and William L. Vault Mar. 1990 20 p
(AD-A221552; HDL-TL-90-2) Avail: NTIS HC A03/MF A01 CSCL 20/5

The public has expressed concern about the biological effects and hazards of non-ionizing electromagnetic fields produced by the electro-magnetic pulse (EMP) simulators that simulate the EMP emanating from a high-altitude nuclear explosion. This paper provides a summary of the bioelectromagnetic effects literature up through the present, describes current occupational standards for workers exposed to the EMP environment, and discusses the use of medical surveillance as it relates to the potential human health hazards associated with exposure to the EMP environment. GRA

52 AEROSPACE MEDICINE

Includes physiological factors; biological effects of radiation; and effects of weightlessness on man and animals.

N90-27244*# Analytics, Inc., Willow Grove, PA.
COCKPIT OCULAR RECORDING SYSTEM (CORS) Final Report
Edward Rothenheber, James Stokes, Charles LaGrossa, William Arnold, and A. O. Dick Washington NASA Mar. 1990 104 p
(Contract NAS1-18473)
(NASA-CR-4281; NAS 1.26:4281; TR-2107) Avail: NTIS HC A06/MF A01 CSCL 06P

The overall goal was the development of a Cockpit Ocular Recording System (CORS). Four tasks were used: (1) the development of the system; (2) the experimentation and improvement of the system; (3) demonstrations of the working system; and (4) system documentation. Overall, the prototype represents a workable and flexibly designed CORS system. For the most part, the hardware use for the prototype system is off-the-shelf. All of the following software was developed specifically: (1) setup software that the user specifies the cockpit configuration and identifies possible areas in which the pilot will look; (2) sensing software which integrates the 60 Hz data from the oculometer and heat orientation sensing unit; (3) processing software which applies a spatiotemporal filter to the lookpoint data to determine fixation/dwell positions; (4) data recording output routines; and (5) playback software which allows the user to retrieve and analyze the data. Several experiments were performed to verify the system accuracy and quantify system deficiencies. These tests resulted in recommendations for any future system that might be constructed. Author

N90-27245# Illinois Univ., Savoy.
THE INTEGRATION OF COMPLEX INFORMATION FROM AUDITORY AND VISUAL CHANNELS UNDER STRESS Final Report
Christopher D. Wickens May 1990 19 p
(DA Proj. 1L1-61102-B7-4A)
(AD-A222686; HEL-TN-5-90) Avail: NTIS HC A03/MF A01 CSCL 06/10

Research that was performed at the University of Illinois Aviation Research Laboratory is described. This research examined how the human operator's ability to integrate multiple channels of information is influenced by stress and by display formatting which brings channels of information closer. In a series of experiments, it was concluded that information integration is facilitated by combining formation channels into a single object display and by the use of common color. These manipulations do not necessarily

facilitate dual task performance or focused attention. Some important distinctions in the creation of object displays are also described. It was also concluded that the use of common perceptual modalities (all visual) or spatial proximity does not enhance information integration ability relative to dual task performance. The use of a single hand to perform two integrated response actions can facilitate performance, particularly if one action is continuous and the other is discrete. In some studies, the effects of mild stressors were imposed to enhance benefits associated with multi-task auditory displays and to enhance the benefits of object displays. GRA

N90-27246# Environmental Protection Agency, Research Triangle Park, NC. Human Studies Div.
NEUROBEHAVIORAL EFFECTS OF CARBON MONOXIDE (CO) EXPOSURE IN HUMANS: ELEVATED CARBOXYHEMOGLOBIN (COHb) AND CEREBROVASCULAR RESPONSES Final Report, 1985 - 1989
Vernon A. Benignus, Matthew L. Petrovick, and James D. Prah (North Carolina Univ., Chapel Hill.) 19 May 1989 58 p
(DA Proj. 3E1-62777-A-878)
(AD-A222840) Avail: NTIS HC A04/MF A01 CSCL 06/14

A two-channel cranial impedance plethysmography (CIP) was designed and constructed as a noninvasive measure of brain blood flow (BBF) in man. The instrument was designed to reduce some of the problems with instability and difficulty of use found in earlier commercially-available models. The CIP was previously validated against other measures of BBF. During carboxylhemoglobin (COHb) formation, BBF is known to increase. When BBF increases it compensates for the reduced ability of the blood to carry oxygen in the presence of COHb. Fifteen men breathed carbon monoxide to produce increases in COHb values range from endogenous 18.4 percent. GRA

N90-27247# Naval Medical Research Inst., Bethesda, MD.
WORK ENHANCEMENT AND THERMAL CHANGES DURING INTERMITTENT WORK IN COOL WATER AFTER CARBOHYDRATE LOADING Technical Report, Feb. - May 1988
J. W. Thorp, K. D. Mittleman, K. J. Haberman, J. F. House, and T. J. Doubt Mar. 1990 36 p
(AD-A222877; NMRI-90-14) Avail: NTIS HC A03/MF A01 CSCL 06/1

The effect was evaluated of carbohydrate loading (TEST) vs control diet (CON) on the thermal status and the ability of 8 U.S. Navy divers to perform intermittent leg exercise at 80 percent max Oxygen 2 consumption during head-out immersion in 25 C water. Each subject was tested once after 3 days of the TEST diet (600 grams carbohydrate/day) and once after 3 days of CON diet (less than 300 g carbohydrate/d). The TEST diet included 200 to 400 grams of glucose polymer solution (GPS). Both diets were nutritionally complete and provided 3000 Kcal/d. A pattern of 10 min rest/20 min work was repeated until the diver could no longer complete a 20-min work session or until 8 sessions had been completed. Divers completed more work after TEST than CON. Four completed all 8 work sessions after both diets; 3 completed all sessions after TEST, but not CON; one completed 7 sessions after TEST and 6 after CON. Differences between diets for O2 consumption, CO2 production, and minute ventilation were not significant. GRA

N90-27248# Pacific-Sierra Research Corp., Los Angeles, CA.
EFFECTS OF IONIZING RADIATION ON THE PERFORMANCE OF SELECTED TACTICAL COMBAT CREWS Technical Report, 12 Mar. 1986 - 30 Oct. 1987
M. A. Dore and G. H. Anno 1 May 1990 138 p
(Contract DNA001-85-C-0352)
(AD-A222880; PSR-1846; DNA-TR-88-173) Avail: NTIS HC A07/MF A01 CSCL 06/4

A general model is developed for characterizing the expected performance of four selected types of tactical army combat crews when the individual crewmembers function at degraded performance levels due to acute exposure to ionizing radiation. The model is also applicable to other situations that degrade individual crewmember performance. The results provide performance data for larger scale U.S. Army models that simulate battlefield conflicts where nuclear weapons might be employed. Performance-level data are generated as a function of dose and time after exposure for each crew type. GRA

N90-27249# McGill Univ., Montreal (Quebec). Computer Vision and Robotics Lab.
CURVATURE ESTIMATION IN ORIENTATION SELECTION Annual Technical Report, 1 Feb. 1989 - 31 Jan. 1990
Steven W. Zucker and Max S. Cynader (British Columbia Univ., Vancouver.) 29 Mar. 1990 5 p
(Grant AF-AFOSR-0260-89; AF Proj. 2313)
(AD-A221481; AFOSR-90-0422TR) Avail: NTIS HC A01/MF A01 CSCL 06/4

This research effort is concentrated on the computational neuroscience of early vision. Progress was made on the following problems: (1) a model of end-stopped visual cortical neurons was extended to include complex components; (2) an extensive simulation of the model was completed with regard to orientation, positional, spatial frequency, curvature, chevron, and end-line sensitivity; (3) orientation discontinuities were extended into the motion domain, and psychophysical and computational experiments confirm the hypothesis of multiple directions being represented at a point of discontinuity; and (4) the mathematical foundations were laid for a theory of shape. GRA

N90-27250# Massachusetts Univ., Worcester. Dept. of Neurology.
NON-LINEAR ANALYSIS OF VISUAL CORTICAL NEURONS Annual Report No. 1, 1 Jan. - 31 Oct. 1989
Lowell D. Jacobson, James P. Gaska, and Daniel A. Pollen 12 Mar. 1990 7 p
(Grant AF-AFOSR-0247-89; AF Proj. 2313)
(AD-A221543; AFOSR-90-0429TR) Avail: NTIS HC A02/MF A01 CSCL 23/3

New equipment was purchased and set up and new software was developed in preparation for electrophysiological experiments to study the neural networks that underly the binocular non-linear filtering properties of cells in the monkey (Macaca fascicularis) visual cortex. This preparatory task was completed. In addition, new methods were developed for using input-output measurements to identify multi-input nonlinear systems. In addition, the new system identification methods were applied in preliminary analyses of previously obtained monocular stimulus-response data. GRA

N90-27251# Harvard Univ., Cambridge, MA. Div. of Applied Sciences.
THE EFFECTS OF LUMINANCE BOUNDARIES ON COLOR PERCEPTION Annual Technical Report, 15 Mar. 1989 - 14 Mar. 1990
Richard E. Kronauer, R. T. Eskew, Jr., and C. F. Stromeyer, III 12 Apr. 1990 16 p
(Grant AF-AFOSR-0304-89; AF Proj. 2313)
(AD-A221544; AFOSR-90-0419TR) Avail: NTIS HC A03/MF A01 CSCL 20/6

When a suprathreshold luminance flash, presented as an increment on a larger background field, accompanies a circular equiluminant chromatic flash at the same spatial location, the chromatic threshold is reduced by about two-fold. This facilitation results from the clearly-visible edges of the luminance flash (the pedestal) serving to demarcate the test region, segregating it from its surround. Signal detection experiments show that this facilitation does not occur because the contour reduces the spatio-temporal detection uncertainty of the observer. Partial and incomplete luminance contours produce partial facilitation. An illusory contour pattern can produce the full facilitation effect, measured with a forced-choice method. Recent experiments show that a thin luminance line which bisects the test region produces weak facilitation, the amount of which varies slightly with line length. This result poses a challenge to simple models of the facilitation mechanism, since the line does not demarcate two differently

colored regions. The facilitation effect can be used as a rigorous means of probing the way in which low level visual attributes (edge, color) interact at higher levels. GRA

N90-27252# Central Inst. for the Deaf, Saint Louis, MO.
BINAURAL MASKING: AN ANALYSIS OF MODELS Annual Technical Report, 1 Apr. 1989 - 31 Mar. 1990
Robert H. Gilkey 30 Apr. 1990 12 p
(Grant AF-AFOSR-0302-89; AF Proj. 2313)
(AD-A221668; AFOSR-90-0632TR) Avail: NTIS HC A03/MF A01 CSCL 06/4

The ultimate goal is to specify the transformations of the auditory stimulus used by the subject to determine the presence or absence of a signal when masked by an interfering sound, with particular emphasis on the role of processes that compare information in the frequency domain and in the time domain, and on the relation between monaural and binaural processing. Traditional psychophysical procedures are combined with new techniques (molecular psychophysics), which allow the data to be examined in considerably, greater detail. With these techniques, conclusions and theories based on more general analyses are often shown to be inadequate. A number of experiments were conducted to evaluate models of monaural and binaural masking. The responses of subjects to individual noise-alone and signal-plus-noise waveforms could not be predicted based on the energy in a single auditory filter or a linear combination of several auditory filters. GRA

N90-27253# State Univ. of New York, Plattsburgh.
THE EFFECTS OF BLAST TRAUMA (IMPULSE NOISE) ON HEARING: A PARAMETRIC STUDY SOURCE 2 Annual Report No. 3
Roger P. Hamernik, William A. Ahroon, Robert I. Davis, Keng D. Hsueh, and George A. Turrentine Dec. 1989 52 p
(Contract DAMD17-86-C-6172; DA Proj. 3M1-61102-BS-15)
(AD-A221731; ARL-90-2) Avail: NTIS HC A04/MF A01 CSCL 06/4

There are three broad goals to this contract. The first and primary goal is to study the effects of high level blast wave exposure on the conductive and sensory structures of the mammalian ear. This includes the use of the auditory evoked potential to measure hearing thresholds and tuning curves prior to and after exposure to various blast wave exposures. Parameters of the blast waves studied include intensity, spectral composition, number of impulses and repetition rate. Correlations among hearing measures, exposure variables and histology have been developed. To achieve the above, the following two objectives must be completed: (1) develop a series of blast wave generation devices which are suitable for the laboratory simulation of a wide spectrum of blast waves; and (2) develop suitable software and a PC-based computer system which will interact with crystal and capacitive microphones to capture and analyze blast waves. Four sources have been developed along with the specified analysis system. The results from the Source I (a conventional shock tube) were summarized in reports ADA 206-180 and ADA 203-854. This report summarizes the results from Source II, a 5-inch Lamont valve-driven shock tube. GRA

53 BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

N90-27254# Carnegie-Mellon Univ., Pittsburgh, PA. Artificial Intelligence and Psychology Project.
SYMBOLIC ARCHITECTURES FOR COGNITION Technical Report, 15 Sep. 1986 - 14 Sep. 1991
Allen Newell, Paul S. Rosenbloom, and John E. Laird (Michigan Univ., Ann Arbor.) 1989 42 p Submitted for publication
(Contract N00014-86-K-0678)
(AD-A222909; AIP-62) Avail: NTIS HC A03/MF A01 CSCL 05/8

This chapter treats the architecture, which is the fixed structure that provides the frame within which cognitive processing in the mind takes place. It describes what an architecture is and how it enters into cognitive theories of the mind. It concentrates on symbolic architectures, the family that includes the architectures central to computer science. It does not treat foundational matters or connectionist architectures. After treating in detail the general requirements of a cognitive architecture, it uses Act and Soar, two architectures relevant to the study of human cognition, to illustrate matters in detail. GRA

N90-27255# Naval Health Research Center, San Diego, CA.
THE INTEGRATED AREA MEASURE OF VISUAL ENDOGENOUS ERPS: RELATION TO COGNITIVE WORKLOAD AND HEMISPHERE Final Report
Lex L. Merrill and David J. Hord Jun. 1989 23 p Sponsored by Naval Medical Research and Command, Bethesda, MD
(AD-A223191; NHRC-89-25) Avail: NTIS HC A03/MF A01 CSCL 06/4

The Integrated Area Measure (IAM) of event-related brain potentials components was assessed as a simple method of quantifying cognitive workload. Additionally, the hypothesis of Miskin and Appenzeller that the right hemisphere is more involved in visual processing than the left was evaluated. One hundred and two U.S. Navymen were used as subjects and each subject completed a baseline and an oddball visual task. EEG was recorded at two electrode sites (C3 and C4). The results indicate that the IAM may be useful as a measure of cognitive workload. The IAM showed that stimulus discrimination was not greater for the right hemisphere; therefore, the hypothesis of Miskin and Appenzeller was not supported. However, the IAM for the right hemisphere was significantly larger than the left hemisphere measure for discrimination memory. The present data may suggest that the right hemisphere generates the required activity for the updating of working memory. The IAM may ultimately prove to be a useful tool for monitoring the cognitive activity of personnel. GRA

N90-27256# Naval Health Research Center, San Diego, CA.
MELATONIN, LIGHT AND, CIRCADIAN CYCLES Interim Report
Tamsin Lisa Kelly, Deborah Smith, and Paul Naitoh 25 Dec. 1989 61 p Sponsored by Naval Medical Research and Development Command, Bethesda, MD
(AD-A223196; NHRC-89-38) Avail: NTIS HC A04/MF A01 CSCL 06/5

The body's circadian rhythms affect many aspects of human psychology, physiology, and performance. Melatonin, a hormone secreted by the pineal, is an important element of human circadian rhythmicity. Melatonin is normally at a low level during the day, with a pulse of secretion at night. The timing of melatonin secretion is controlled by the suprachiasmatic nuclei of the hypothalamus. The neuronal pathways which mediate this control are discussed. Light exposure is the main factor which adjusts the hypothalamic clock that controls melatonin release. Melatonin is altered in many disease states. It interacts with other endocrine systems. It probably plays a role in jet lag. Various drugs, including many that are commonly used and are likely to be taken by military personnel, can affect the melatonin system at different levels: by shifting the hypothalamic clock which controls melatonin release; by directly suppressing release at the level of the pineal, without altering the underlying rhythm; or by altering or blocking the effects of melatonin after it has been released. GRA

N90-27257# Air Force Human Resources Lab., Brooks AFB, TX. Manpower and Personnel Div.
CROSS-VALIDATION OF EXPERIMENTAL USAF PILOT TRAINING PERFORMANCE MODELS Interim Report, Jul. 1986 - Aug. 1989
Thomas R. Carretta May 1990 12 p
(AF Proj. 7719)

(AD-A222253; AFHRL-TR-89-68) Avail: NTIS HC A03/MF A01 CSCL 05/9

A series of studies have indicated that individual differences in hand-eye coordination, information processing ability, personality and attitudes are related to USAF pilot training performance. The current investigation was designed to cross-validate these results. Eight hundred eighty five (885) USAF Undergraduate Pilot Training (UPT) students were divided randomly into two groups. Pilot selection models that used a combination of Air Force Officer Qualifying Test (AFOQT) and Basic Attributes Test (BAT) battery scores were developed independently for each group and then cross-validated with the other group. In the model development phase, subjects with good hand-eye coordination who made quick decisions were more likely to complete UPT successfully in both groups. Although there was some reduction in the validity coefficients in the cross-validation phase, the selection models were related significantly to UPT final outcome in both groups. These results suggest that the AFOQT/BAT pilot selection models are sufficiently robust to be used as adjuncts to operational USAF pilot trainee selection procedures. GRA

N90-27258# Naval Personnel Research and Development Center, San Diego, CA.

REAL-TIME MEASUREMENT OF MENTAL WORKLOAD USING PSYCHOPHYSIOLOGICAL MEASURES Interim Report, Jan. - Dec. 1989

Darryl Humphrey, Erik Sirevaag, Arthur F. Kramer, and Axel Mecklinger (Technische Univ., Berlin, Germany, F.R.) Apr. 1990 21 p Presented at the 3rd Annual Workshop on Space Operations, Automation, and Robotics, Houston, TX, 1989; sponsored by ONR Sponsored by Office of Naval Technology, Arlington, VA (AD-A221462; NPRDC-TN-90-18) Avail: NTIS HC A03/MF A01 CSCL 05/8

The primary goal of the research was to explore the utility of event-related potentials (ERPs) as real-time measures of mental workload. Subjects performed a six-gauge monitoring task and a mental arithmetic task concurrently and at several difficulty levels. Difficulty was varied in terms of gauge predictability and by using two or three column arithmetic problems. A bootstrapping approach was adopted in which 1,000 samples of n trials (n=1,3,5,...65 single trials) were classified as to mental workload level using ERP measures (P300 and slow wave amplitude). Classification accuracies of 85 percent were achieved with 25 trials. Results are discussed in terms of potential enhancements for real-time recording of performance monitoring. GRA

N90-27259# Dayton Univ., OH. Research Inst.

AUTOMATIC INFORMATION PROCESSING AND HIGH PERFORMANCE SKILLS: APPLICATION TO TRAINING Interim Technical Report, Aug. 1988 - Oct. 1989

F. Thomas Eggemeier, Andrea B. Granitz, Timothy E. Rogus, and Eric E. Geiselman Apr. 1990 114 p
(Contract F33615-88-C-0015)
(AD-A221709; AFHRL-TR-89-70) Avail: NTIS HC A06/MF A01 CSCL 05/6

This report documents a laboratory research effort to investigate the application of automatic processing theory to analogs of complex command and control (C2) operator tasks. Six experiments were performed to investigate complex skill acquisition and transfer of training. The results indicate that elements of automatic processing theory can be applied to training complex task analogs, and suggest that transfer of this training is relatively unaffected by certain changes in the presentation format of investigation. GRA

N90-27260# Georgia Inst. of Tech., Atlanta. School of Psychology.

AUTOMATIC INFORMATION PROCESSING AND HIGH PERFORMANCE SKILLS: ACQUISITION, TRANSFER, AND RETENTION Interim Technical Report, Aug. 1988 - Oct. 1989

Arthur D. Fisk, Kevin A. Hodge, Mark D. Lee, and Wendy A. Rogers Apr. 1990 145 p
(Contract F33615-88-C-0015)
(AD-A221744; AFHRL-TR-89-69) Avail: NTIS HC A07/MF A01 CSCL 05/2

Ten experiments involving basic laboratory research on automatic processing theory and skill acquisition are reviewed. The experiments were conducted to investigate the following issues: effects of modified practice, transfer of training, skill decay, and retention. The results of this work provide an understanding of skill acquisition, retention, and transfer with respect to high performance skills training. GRA

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

For related information see also *16 Space Transportation.*

N90-27261*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, AL.

ROTATIONALLY ACTUATED PROSTHETIC HELPING HAND Patent Application

William E. Norton, inventor (to NASA), Jewell G. Belcher, Jr., inventor (to NASA), James R. Carden, inventor (to NASA), and Thomas W. Vest, inventor (to NASA) (Membrane Systems, Inc., San Diego, CA.) 12 Apr. 1990 14 p
(NASA-Case-MFS-28426-1; NAS 1.71:MFS-28426-1; US-Patent-Appl-SN-508154) Avail: NTIS HC A03/MF A01 CSCL 05H

A prosthetic device for below-the-elbow amputees having a cuff, a stem, a housing, two hook-like fingers, an elastic band for holding the fingers together, and a brace, is disclosed. The fingers are pivotally mounted on a housing that it secured to the amputee's upper arm with the brace. The stem, which also contains a cam, is rotationally mounted within the housing and is secured to the cuff, which fits over the amputee's stump. By rotating the cammed stem between the fingers with the lower arm, the amputee can open and close the fingers. NASA

N90-27262# North Carolina Univ., Chapel Hill. Dept. of Computer Science.

A REAL-TIME OPTICAL 6D TRACKER FOR HEAD-MOUNTED DISPLAY SYSTEMS Ph.D. Thesis

Jih-Fang Wang Mar. 1990 99 p
(Contract N00014-86-K-0680)
(AD-A222884; TR90-011) Avail: NTIS HC A05/MF A01 CSCL 17/11

Significant advance has been made towards realistic synthesis and display of 3-D objects using computers during the past two decades. However, the interaction between human and computer generated scenes remains largely remote through devices such as keyboards, mice, joysticks, etc. Head mounted display provides a mechanism for much more realistic visualizing and interacting with computer generated 3D scenes through the hand-eye-body coordination exercised daily. Head mounted display systems require that the position and orientation of the user's head be tracked in real time with high accuracy in a large working environment. Current 6D positional tracking devices (3 translational and 3 rotational parameters) fail to satisfy these requirements. A new system for real time, 6-D position tracking is introduced, studied, and documented. This system adopts an inside-out tracking paradigm. The working environment is a room in which the ceiling is lined with a regular pattern of infrared LED beacons which are flashing (invisible to the human eyes) under the system's control. Three cameras are mounted on a helmet which the user wears. Each camera uses a lateral effect photodiode as the recording surface. The 2D image positions of the flashing beacons inside the field of view of the cameras are recorded and reported in real time. The measured 2D image positions and the known 3D positions of beacons are used to compute the position of the camera assembly in space. GRA

N90-27263# Army Aeromedical Research Lab., Fort Rucker, AL. Sensory Research Div.

HUMAN FACTORS AND SAFETY CONSIDERATIONS OF NIGHT VISION SYSTEMS FLIGHT USING THERMAL IMAGING SYSTEMS Final Report

Clarence E. Rash, Robert W. Verona, and John S. Crowley (Army Safety Center, Fort Rucker, AL.) Apr. 1990 33 p Repr. from 1990 Technical Symposium on Aerospace Sensing (SPIE), 16-20 Apr. 1990 Submitted for publication

(DA Proj. 3M1-62787-A-879)

(AD-A223226; USAARL-90-10) Avail: NTIS HC A03/MF A01 CSCL 20/6

Military aviation night vision systems enhance the aviator's capability to operate effectively during periods of low illumination, adverse weather, and in the presence of obscurants. Current fielded systems allow aviators to conduct terrain flight during conditions which would be extremely dangerous, if not impossible, using only unaided vision. In night vision systems, trade-offs are made that enhance some visual parameters and compromise others. Examples of visual parameters which are traded off include acuity, field-of-view, spectral sensitivity, and depth perception. Cost, weight, and size constraints also lead to compromises between the ideal and a viable system design, Thermal imaging sensors introduce enhanced night vision capabilities along with new problems associated with the interpretation of visual information based on spectral and spatial characteristics differing from those provided by unaided vision. GRA

N90-27264# Virginia Commonwealth Univ., Richmond. Dept. of Occupational Therapy.

THE RELATIONSHIP OF ISOMETRIC GRIP STRENGTH, OPTIMAL DYNAMOMETER SETTINGS, AND CERTAIN ANTHROPOMETRIC FACTORS M.S. Thesis

Michael Scot Reith May 1990 139 p Sponsored by AFIT, Wright-Patterson AFB, OH

(AD-A222046; AFIT/CI/CIA-90-020) Avail: NTIS HC A07/MF A01 CSCL 23/2

A study was conducted to determine: (1) the relationships between isometric grip strength and eight anthropometric dimensions of the upper extremity, (2) the relationship between isometric grip strength and handle position of the Jamar dynamometer, and (3) a means of predicting optimal positioning of the Jamar dynamometer handle. Measurements were taken from 30 females between the ages of 21 and 25. Data were analyzed by means of the Pearson product-moment correlation, ANOVA and multiple ANOVA, predictive discrimination, and multiple regression. Significant correlations (p less than .05) existed between all dimensions of the hand and grip strength in all handle positions except the smallest, ranging from .36 to .61. Analysis of variance demonstrated significant differences between strength at the different handle positions. The results support the use of position two or three of the Jamar dynamometer handle for testing of maximum grip strength. Specific adjustment of the dynamometer handle seems unnecessary, but if desired it should be based upon hand length or length of the long digit. No anthropometric dimension appears to be strong enough to predict grip strength. GRA

N90-27265# Carnegie-Mellon Univ., Pittsburgh, PA. Dept. of Psychology.

RULE ACQUISITION EVENTS IN THE DISCOVERY OF PROBLEM SOLVING STRATEGIES Final Technical Report, 1 Jan. 1988 - 31 Dec. 1990

Kurt A. VanLehn Jul. 1989 60 p Submitted for publication

(Contracts N00014-88-K-0086; N00014-86-K-0678)

(AD-A222428; PCG-17) Avail: NTIS HC A04/MF A01 CSCL 05/8

Although there are many machine learning programs that can acquire new problem solving strategies, we do not know exactly how their processes will manifest themselves in human behavior, if at all. In order to find out, a line-by-line protocol analysis was conducted of a subject discovering problem solving strategies. A model was developed that could explain 96 percent of the lines in the procol. On this analysis, the subject's learning was confined to 11 rule acquisition events, wherein she temporarily abandoned her normal problem solving and focused on improving her strategic knowledge. Further analysis showed that: (1) Not rule acquisition events are triggered by impasses. (2) Rules are acquired gradually, both because of competition between new and old rules, and because of the subject's apparently deliberate policy of gradual generalization. (3) This subject took a scientific approach to strategy discovery, even planning and conducting small experiments. GRA

N90-27266# North Carolina Univ., Chapel Hill. Dept. of Computer Science.

TRACKING A HEAD-MOUNTED DISPLAY IN A ROOM-SIZED ENVIRONMENT WITH HEAD-MOUNTED CAMERAS

Jih-Fang Wang, Ronald Azuma, Gary Bishop, Vernon Chi, John Eyles, and Henry Fuchs 1990 11 p Presented at the 1990 Technical Symposium on Optical Engineering and Photonics in Aerospace Sensing, Orlando, FL, Apr. 1990 Submitted for publication

(Contract N00014-86-K-0680; NIH-RR-02170)

(AD-A222545) Avail: NTIS HC A03/MF A01 CSCL 17/5

This paper presents our efforts to accurately track a Head Mounted Display (HMD) in a large environment. We review our current benchtop prototype (introduced in (WCF90)), then describe our plans for building the full-scale system. Both systems use an inside-out optical tracking scheme, where lateral-effect photodiodes mounted on the user's helmet view flashing infrared beacons placed in the environment. Church's method uses the measured 2D image positions and the known 3D beacon locations to recover the 3D position and orientation of the helmet in real-time. We discuss the implementation and performance of the benchtop prototype. The full-scale system design includes ceiling panels that hold the infrared beacons and a new sensor arrangement of two photodiodes with holographic lenses. In the full-scale system, the user can walk almost anywhere under the grid of ceiling panels, making the working volume nearly as large as the room. GRA

N90-27267# Anacapa Sciences, Inc., Fort Rucker, AL.

HUMAN FACTORS RESEARCH IN AIRCREW PERFORMANCE AND TRAINING Final Report, Oct. 1988 - Oct. 1989

Michael McAnulty, ed. Mar. 1990 146 p

(Contract MDA903-87-C-0523)

(AD-A221657; ASI690-326-89; ARI-TR-884) Avail: NTIS HC A07/MF A01 CSCL 01/1

Summary descriptions are presented emerging aviation weapon systems design, manpower and personnel programs, aviator training, and aviation safety research. The summary description for each project and technical advisory service contains a background section that describes the rationale for the project and specifies the research objectives; a research approach section that describes the tasks and activities required to meet the project objectives; a research findings section or, in the case of developmental activities, a research products section; and a project status section that describes projections for future research. GRA

N90-27276*# Boeing Co., Huntsville, AL.

AGENT INDEPENDENT TASK PLANNING

William S. Davis *In* NASA, Marshall Space Flight Center, Fifth Conference on Artificial Intelligence for Space Applications May 1990 p 1-10 (For primary document see N90-27275 21-61)

Avail: NTIS HC A25/MF A04 CSCL 05H

N90-27294*# Vanderbilt Univ., Nashville, TN.

A STUDY ON DIAGNOSABILITY OF SPACE STATION ECLSS

S. Padalkar, W. Blokland, and J. Sztipanovits *In* NASA, Marshall Space Flight Center, Fifth Conference on Artificial Intelligence for Space Applications May 1990 p 165-174 Sponsored in part by Boeing Aerospace Co., Huntsville, AL (For primary document see N90-27275 21-61)

Avail: NTIS HC A25/MF A04 CSCL 06K

N90-27297*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, AL.
SPACE STATION FREEDOM ECLSS: A STEP TOWARD AUTONOMOUS REGENERATIVE LIFE SUPPORT SYSTEMS
Brandon S. Dewberry *In its* Fifth Conference on Artificial Intelligence for Space Applications May 1990 p 193-201 (For primary document see N90-27275 21-61)
Avail: NTIS HC A25/MF A04 CSCL 06K

N90-27298*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, AL.
SIMULATION-BASED INTELLIGENT ROBOTIC AGENT FOR SPACE STATION FREEDOM
Csaba A. Biegl, James F. Springfield, George E. Cook, and Kenneth R. Fernandez (Vanderbilt Univ., Nashville, TN.) *In its* Fifth Conference on Artificial Intelligence for Space Applications May 1990 p 203-210 (For primary document see N90-27275 21-61)
Avail: NTIS HC A25/MF A04 CSCL 05H

N90-27303*# Mitre Corp., McLean, VA. Artificial Intelligence Technical Center.
CREATURE CO-OP: ACHIEVING ROBUST REMOTE OPERATIONS WITH A COMMUNITY OF LOW-COST ROBOTS
R. Peter Bonasso *In* NASA, Marshall Space Flight Center, Fifth Conference on Artificial Intelligence for Space Applications May 1990 p 257-269 (For primary document see N90-27275 21-61)
Avail: NTIS HC A25/MF A04 CSCL 05H

N90-27311*# Boeing Aerospace Co., Huntsville, AL. Advanced Civil Space Systems.
A VISION-BASED TELEROBOTIC CONTROL STATION
Brian Tillotson *In* NASA, Marshall Space Flight Center, Fifth Conference on Artificial Intelligence for Space Applications May 1990 p 325-329 (For primary document see N90-27275 21-61)
Avail: NTIS HC A25/MF A04 CSCL 05H

N90-27314*# Rockwell International Corp., Downey, CA. Space Transportation Systems Div.
A MODEL FOR A SPACE SHUTTLE SAFING AND FAILURE-DETECTION EXPERT
Daphna Zeilingold and John Hoey *In* NASA, Marshall Space Flight Center, Fifth Conference on Artificial Intelligence for Space Applications May 1990 p 351-359 (For primary document see N90-27275 21-61)
Avail: NTIS HC A25/MF A04 CSCL 06K

N90-27331*# Alabama A & M Univ., Normal. Dept. of Computer and Information Sciences.
RESOLUTION OF SEVEN-AXIS MANIPULATOR REDUNDANCY: A HEURISTIC ISSUE
I. Chen *In* NASA, Marshall Space Flight Center, Fifth Conference on Artificial Intelligence for Space Applications May 1990 p 535-543 (For primary document see N90-27275 21-61)
(Grant NAG8-023)
Avail: NTIS HC A25/MF A04 CSCL 05H

N90-27333*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, AL.
ROBOT DYNAMICS IN REDUCED GRAVITY ENVIRONMENT
Gary L. Workman, Tollie Grisham (Alabama Univ., Huntsville.), Elaine Hinman, and Cindy Coker *In its* Fifth Conference on Artificial Intelligence for Space Applications May 1990 p 551-556 (For primary document see N90-27275 21-61)
Avail: NTIS HC A25/MF A04 CSCL 05H

55 SPACE BIOLOGY

Includes exobiology; planetary biology; and extraterrestrial life.

No abstracts in this category.

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

No abstracts in this category.

60 COMPUTER OPERATIONS AND HARDWARE

Includes hardware for computer graphics, firmware, and data processing.

For components see *33 Electronics and Electrical Engineering.*

N90-27268*# National Aeronautics and Space Administration. Pasadena Office, CA.
SPECIAL PURPOSE PARALLEL COMPUTER ARCHITECTURE FOR REAL-TIME CONTROL AND SIMULATION IN ROBOTIC APPLICATIONS Patent Application
Amir Fijany, inventor (to NASA) and Antal K. Bejczy, inventor (to NASA) (Jet Propulsion Lab., California Inst. of Tech., Pasadena.) 28 Dec. 1989 18 p
(Contract NAS7-918)
(NASA-Case-NPO-17629-1-CU; NAS 1.71:NPO-17629-1-CU; US-Patent-Appl-SN-458280) Avail: NTIS HC A03/MF A01 CSCL 09B

This is a real-time robotic controller and simulator which is a MIMD-SIMD parallel architecture for interfacing with an external host computer and providing a high degree of parallelism in computations for robotic control and simulation. It includes a host processor for receiving instructions from the external host computer and for transmitting answers to the external host computer. There are a plurality of SIMD micro-processors, each SIMD processor being a SIMD parallel processor capable of exploiting fine grain parallelism and further being able to operate asynchronously to form a MIMD architecture. Each SIMD processor comprises a SIMD architecture capable of performing two matrix-vector operations in parallel while fully exploiting parallelism in each operation. There is a system bus connecting the host processor to the plurality of SIMD micro-processors and a common clock providing a continuous sequence of clock pulses. There is also a ring structure interconnecting the plurality of SIMD micro-processors and connected to the clock for providing the clock pulses to the SIMD micro-processors and for providing a path for the flow of data and instructions between the SIMD micro-processors. The host processor includes logic for controlling the RRCS by interpreting instructions sent by the external host computer, decomposing the instructions into a series of computations to be performed by the SIMD micro-processors, using the system bus to distribute associated data among the SIMD micro-processors, and initiating activity of the SIMD micro-processors to perform the computations on the data by procedure call. NASA

N90-27269# North Carolina Univ., Chapel Hill. Dept. of Computer Science.
A COMPUTER FOR LOW CONTEST-SWITCH TIME Ph.D. Thesis
Mark Charles Davis Mar. 1990 141 p

(Contract N00014-86-K-0680)
(AD-A222883; TR90-012) Avail: NTIS HC A07/MF A01
CSCL 12/6

A context switch is the suspension of one running process and the activation of another in a multitasking environment. Many applications, such as process control, require frequent context switches among many processes. A context switch requires a substantial amount of time: about 1000 microseconds on a VAX 11/780 and about 500 microseconds on Sun 4/280. Recently introduced computer architectures, such as the Sun 4, have not improved context-switch performance as much as they have improved throughput. A computer architecture with appropriate memory hierarchy can give better support to context switching. The Computer for Low Context-Switch Time (CLOCS) is a computer with such an architecture. Because the architecture has minimum state inside the Central Processing Unit, CLOCS can switch context in less than the time required to execute one instruction. The CLOCS Memory Management Unit provides virtual memory without degrading context-switch time as long as the new process is located in physical memory. Analyses of the architecture show that CLOCS throughput performance approaches the performance of contemporary RISC workstations and that it is well suited for real time applications. GRA

N90-27270# Massachusetts Inst. of Tech., Cambridge. Lab. for Computer Science.
KNOWLEDGE AND DISTRIBUTED COMPUTATION Ph.D. Thesis
Mark Tuttle May 1990 242 p
(Contract N00014-83-K-0125)
(AD-A223100; MIT/LCS/TR-477) Avail: NTIS HC A11/MF A02 CSCL 12/7

Understanding systems of agents that interact in some way is fundamental to many areas of science, including philosophy, linguistics, economics, game theory, logic artificial intelligence, robotics, and distributed computing. As we try to understand these systems, we often find ourselves reasoning (at least informally) about the knowledge these agents have about other agents. Recent work has shown that these informal notions of knowledge can be made precise in the context of computer science. In this thesis, we provide convincing evidence that reasoning in terms of knowledge can lead to general, unifying results about distributed computation, and we extend the standard definitions of knowledge and apply them in new contexts such as cryptography. GRA

N90-27271# California Univ., Berkeley. Computer Science Div.
DEVELOPMENT OF PROBABILISTIC AND POSSIBILISTIC APPROACHES TO APPROXIMATE REASONING AND ITS APPLICATIONS Final Report, 1 Nov. 1988 - 31 Oct. 1989
Lotfi A. Zadeh 31 Oct. 1989 4 p
(Grant AF-AFOSR-0084-89; AF Proj. 2304)
(AD-A221945; AFOSR-90-0394TR) Avail: NTIS HC A01/MF A01 CSCL 12/6

The research has been focused in the main on the development of fuzzy logic and its applications in three problem areas: (1) qualitative systems analysis; (2) imprecise knowledge representation; and (3) neural network control of fuzzy rule-based systems. These problem areas are of direct relevance to the analysis and design of both control and knowledge-based systems which operate in an environment of uncertainty or imprecision. In the realm of qualitative systems analysis, a basic problem studied is the following. Assume that a system is comprised of an interconnection of n components, with the qualitative input-output relation of each component characterized by a collection of fuzzy if-then rules involving linguistic variables. The problem is to compute the qualitative input-output relation of the system from the specifications of the qualitative input-output relations of its components. An effective solution to this problem was obtained through the use of what might be called FA-Prolog. FA-Prolog is a subset of Fuzzy Prolog in which the certainty factors are assumed to be equal to one. With this simplifying assumption, the fuzzy if-then rules can be handled in a straight-forward way and the determination of the qualitative input-output relation reduces to the execution of an FA-Prolog program. GRA

N90-27272# University of Southern California, Marina del Rey. Information Sciences Inst.
SUPERCOMPUTER WORKSTATION COMMUNICATION Special Report
Alan Katz and Stephen Casner Jun. 1989 27 p
(Contract MDA903-87-C-0719)
(AD-A222466; ISI/SR-89-235) Avail: NTIS HC A03/MF A01 CSCL 12/7

This is the final report of the Supercomputer Workstation Communication (SWC) project. The project explored new techniques for using high capacity networks to communicate between personal workstations and remote supercomputers. The effort involved evaluation and testing of standard IP/TCP-based protocols, as well as newer remote window protocols such as MIT's X Window System and Sun Microsystems' NeWS. The DARPA Wideband Satellite Network provided the high capacity, long distance communication path for many of these tests. Additional areas of research included a preliminary study of a proposed Intelligent Communication Facility and an investigation of the current and future user requirements of the scientific community that will use supercomputers. GRA

N90-27304*# Boeing Computer Services Co., Seattle, WA. Advanced Technology Center.
DESIGN KNOWLEDGE CAPTURE FOR A CORPORATE MEMORY FACILITY
John H. Boose, David B. Shema, and Jeffrey M. Bradshaw *In* NASA, Marshall Space Flight Center, Fifth Conference on Artificial Intelligence for Space Applications May 1990 p 271-280 (For primary document see N90-27275 21-61)
Avail: NTIS HC A25/MF A04 CSCL 09B

61 COMPUTER PROGRAMMING AND SOFTWARE

Includes computer programs, routines, alogorithms, and specific applications, e.g., CAD/CAM.

N90-27273*# Houston Univ., Clear Lake, TX. Research Inst. for Computing and Information Systems.
IRDS PROTOTYPING WITH APPLICATIONS TO THE REPRESENTATION OF EA/RA MODELS Final Report
Anthony A. Lekkos and Bruce Greenwood Dec. 1988 61 p
(Contract NCC9-16)
(NASA-CR-186066; NAS 1.26:186066) Avail: NTIS HC A04/MF A01 CSCL 09B

The requirements and system overview for the Information Resources Dictionary System (IRDS) are described. A formal design specification for a scaled down IRDS implementation compatible with the proposed FIPS IRDS standard is contained. The major design objectives for this IRDS will include a menu driven user interface, implementation of basic IRDS operations, and PC compatibility. The IRDS was implemented using Smalltalk/5 object oriented programming system and an ATT 6300 personal computer running under MS-DOS 3.1. The difficulties encountered in using Smalltalk are discussed. B.G.

N90-27274# European Space Agency, Paris (France).
ECOS: THE ESA COSTING SOFTWARE
Norman Longdon, ed. Dec. 1988 32 p Original contains color illustrations
(ESA-BR-56; ISSN-0250-1589) Avail: NTIS HC A03/MF A01

The European Space Agency (ESA) has developed the ESA Costing Software (ECOS) as a data processing tool for the preparation and presentation of cost proposals. Because ESA's projects are shared by member countries, and the work is divided into many parts, the best integrated price tendered for a given project is difficult to judge. Each project is divided into products

by the Work Breakdown Structure. Each product node is further broken down, via a Product Tree, into components such as flight hardware, software, and support equipment. The primary contractor works with a hierarchy of subcontractors who, in turn, have their own subcontractors. ECOS permits the orderly entering of costing data, its analysis, and the evaluation of an integrated price proposal for any project. ECOS also supports ESA's policies of using the latest technology and obtaining the best possible value for ESA's member nations' taxpayers. J.P.S.

N90-27275*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, AL.
FIFTH CONFERENCE ON ARTIFICIAL INTELLIGENCE FOR SPACE APPLICATIONS
Steve L. ODell, comp. Washington May 1990 587 p Conference held in Huntsville, AL, 22-23 May 1990; sponsored in cooperation with Alabama Univ., Huntsville, IEEE, and AIAA
(NASA-CP-3073; M-627; NAS 1.55:3073) Avail: NTIS HC A25/MF A04 CSCL 09B

The Fifth Conference on Artificial Intelligence for Space Applications brings together diverse technical and scientific work in order to help those who employ AI methods in space applications to identify common goals and to address issues of general interest in the AI community. Topics include the following: automation for Space Station; intelligent control, testing, and fault diagnosis; robotics and vision; planning and scheduling; simulation, modeling, and tutoring; development tools and automatic programming; knowledge representation and acquisition; and knowledge base/data base integration. For individual titles, see N90-27276 through N90-27337.

N90-27276*# Boeing Co., Huntsville, AL.
AGENT INDEPENDENT TASK PLANNING **c54**
William S. Davis *In* NASA, Marshall Space Flight Center, Fifth Conference on Artificial Intelligence for Space Applications May 1990 p 1-10 (For primary document see N90-27275 21-61)
Avail: NTIS HC A25/MF A04 CSCL 05H

Agent-Independent Planning is a technique that allows the construction of activity plans without regard to the agent that will perform them. Once generated, a plan is then validated and translated into instructions for a particular agent, whether a robot, crewmember, or software-based control system. Because Space Station Freedom (SSF) is planned for orbital operations for approximately thirty years, it will almost certainly experience numerous enhancements and upgrades, including upgrades in robotic manipulators. Agent-Independent Planning provides the capability to construct plans for SSF operations, independent of specific robotic systems, by combining techniques of object oriented modeling, nonlinear planning and temporal logic. Since a plan is validated using the physical and functional models of a particular agent, new robotic systems can be developed and integrated with existing operations in a robust manner. This technique also provides the capability to generate plans for crewmembers with varying skill levels, and later apply these same plans to more sophisticated robotic manipulators made available by evolutions in technology. Author

N90-27277*# Space Telescope Science Inst., Baltimore, MD.
SPIKE: ARTIFICIAL INTELLIGENCE SCHEDULING FOR HUBBLE SPACE TELESCOPE **c63**
Mark Johnston, Glenn Miller, Jeff Sponsler, Shon Vick, and Robert Jackson (Computer Sciences Corp., Baltimore, MD.) *In* NASA, Marshall Space Flight Center, Fifth Conference on Artificial Intelligence for Space Applications May 1990 p 11-18 (For primary document see N90-27275 21-61)
Avail: NTIS HC A25/MF A04 CSCL 09B

Efficient utilization of spacecraft resources is essential, but the accompanying scheduling problems are often computationally intractable and are difficult to approximate because of the presence of numerous interacting constraints. Artificial intelligence techniques were applied to the scheduling of the NASA/ESA Hubble Space Telescope (HST). This presents a particularly challenging problem since a yearlong observing program can contain some tens of thousands of exposures which are subject to a large number of scientific, operational, spacecraft, and environmental constraints. New techniques were developed for machine reasoning about scheduling constraints and goals, especially in cases where uncertainty is an important scheduling consideration and where resolving conflicts among conflicting preferences is essential. These technique were utilized in a set of workstation based scheduling tools (Spike) for HST. Graphical displays of activities, constraints, and schedules are an important feature of the system. High level scheduling strategies using both rule based and neural network approaches were developed. While the specific constraints implemented are those most relevant to HST, the framework developed is far more general and could easily handle other kinds of scheduling problems. The concept and implementation of the Spike system are described along with some experiments in adapting Spike to other spacecraft scheduling domains. Author

N90-27278*# Alabama Univ., Huntsville. Artificial Intelligence Lab.
RESOURCE ALLOCATION USING CONSTRAINT PROPAGATION **c81**
John S. Rogers *In* NASA, Marshall Space Flight Center, Fifth Conference on Artificial Intelligence for Space Applications May 1990 p 19-24 (For primary document see N90-27275 21-61)
Avail: NTIS HC A25/MF A04 CSCL 05A

The concept of constraint propagation was discussed. Performance increases are possible with careful application of these constraint mechanisms. The degree of performance increase is related to the interdependence of the different activities resource usage. Although this method of applying constraints to activities and resources is often beneficial, it is obvious that this is no panacea cure for the computational woes that are experienced by dynamic resource allocation and scheduling problems. A combined effort for execution optimization in all areas of the system during development and the selection of the appropriate development environment is still the best method of producing an efficient system. Author

N90-27279*# Arizona Univ., Tucson. AI-Simulation Group.
DEVS-BASED INTELLIGENT CONTROL OF SPACE ADAPTED FLUID MIXING **c63**
Sung-Do Chi and Bernard P. Zeigler *In* NASA, Marshall Space Flight Center, Fifth Conference on Artificial Intelligence for Space Applications May 1990 p 25-32 (For primary document see N90-27275 21-61)
(Contract NCC2-525)
Avail: NTIS HC A25/MF A04 CSCL 09B

The development is described of event-based intelligent control system for a space-adapted mixing process by employing the DEVS (Discrete Event System Specification) formalism. In this control paradigm, the controller expects to receive confirming sensor responses to its control commands within definite time windows determined by its DEVS model of the system under control. The DEVS-based intelligent control paradigm was applied in a space-adapted mixing system capable of supporting the laboratory automation aboard a Space Station. Author

N90-27280*# Martin Marietta Corp., Denver, CO.
DYNAMIC TEST INPUT GENERATION FOR MULTIPLE-FAULT ISOLATION **c63**
Phil Schaefer *In* NASA, Marshall Space Flight Center, Fifth Conference on Artificial Intelligence for Space Applications May 1990 p 33-42 (For primary document see N90-27275 21-61)
Avail: NTIS HC A25/MF A04 CSCL 09B

Recent work is Causal Reasoning has provided practical techniques for multiple fault diagnosis. These techniques provide a hypothesis/measurement diagnosis cycle. Using probabilistic methods, they choose the best measurements to make, then update fault hypotheses in response. For many applications such as computers and spacecraft, few measurement points may be accessible, or values may change quickly as the system under diagnosis operates. In these cases, a hypothesis/measurement cycle is insufficient. A technique is presented for a

hypothesis/test-input/measurement diagnosis cycle. In contrast to generating tests a priori for determining device functionality, it dynamically generates tests in response to current knowledge about fault probabilities. It is shown how the mathematics previously used for measurement specification can be applied to the test input generation process. An example from an efficient implementation called Multi-Purpose Causal (MPC) is presented. Author

N90-27281*# Bureau of Mines, Tuscaloosa, AL. Research Center.
GENETIC ALGORITHM BASED FUZZY CONTROL OF SPACECRAFT AUTONOMOUS RENDEZVOUS **c63**
C. L. Karr, L. M. Freeman, and D. L. Meredith (Alabama Univ., Tuscaloosa.) *In* NASA, Marshall Space Flight Center, Fifth Conference on Artificial Intelligence for Space Applications May 1990 p 43-51 (For primary document see N90-27275 21-61)
Avail: NTIS HC A25/MF A04 CSCL 09B

The U.S. Bureau of Mines is currently investigating ways to combine the control capabilities of fuzzy logic with the learning capabilities of genetic algorithms. Fuzzy logic allows for the uncertainty inherent in most control problems to be incorporated into conventional expert systems. Although fuzzy logic based expert systems have been used successfully for controlling a number of physical systems, the selection of acceptable fuzzy membership functions has generally been a subjective decision. High performance fuzzy membership functions for a fuzzy logic controller that manipulates a mathematical model simulating the autonomous rendezvous of spacecraft are learned using a genetic algorithm, a search technique based on the mechanics of natural genetics. The membership functions learned by the genetic algorithm provide for a more efficient fuzzy logic controller than membership functions selected by the authors for the rendezvous problem. Thus, genetic algorithms are potentially an effective and structured approach for learning fuzzy membership functions. Author

N90-27282*# Spectra Research Systems, Inc., Huntsville, AL.
THE APPLICATION OF INTELLIGENT PROCESS CONTROL TO SPACE BASED SYSTEMS **c63**
G. Steve Wakefield *In* NASA, Marshall Space Flight Center, Fifth Conference on Artificial Intelligence for Space Applications May 1990 p 53-58 (For primary document see N90-27275 21-61)
Avail: NTIS HC A25/MF A04 CSCL 09B

The application of Artificial Intelligence to electronic and process control can help attain the autonomy and safety requirements of manned space systems. An overview of documented applications within various industries is presented. The development process is discussed along with associated issues for implementing an intelligence process control system. Author

N90-27283*# Alabama Univ., Huntsville.
ARTIFICIAL INTELLIGENCE IN THE MATERIALS PROCESSING LABORATORY **c63**
Gary L. Workman and William F. Kaukler *In* NASA, Marshall Space Flight Center, Fifth Conference on Artificial Intelligence for Space Applications May 1990 p 59-67 (For primary document see N90-27275 21-61)
(Contract NAS8-36955)
Avail: NTIS HC A25/MF A04 CSCL 09B

Materials science and engineering provides a vast arena for applications of artificial intelligence. Advanced materials research is an area in which challenging requirements confront the researcher, from the drawing board through production and into service. Advanced techniques results in the development of new materials for specialized applications. Hand-in-hand with these new materials are also requirements for state-of-the-art inspection methods to determine the integrity or fitness for service of structures fabricated from these materials. Two problems of current interest to the Materials Processing Laboratory at UAH are an expert system to assist in eddy current inspection of graphite epoxy components for aerospace and an expert system to assist in the design of superalloys for high temperature applications. Each project requires a different approach to reach the defined goals. Results to date are described for the eddy current analysis, but only the original concepts and approaches considered are given for the expert system to design superalloys. Author

N90-27284*# FMC Corp., Santa Clara, CA. Corporate Technology Center.
AN ARCHITECTURE FOR INTELLIGENT TASK INTERRUPTION **c63**
D. D. Sharma and Srini Narayan *In* NASA, Marshall Space Flight Center, Fifth Conference on Artificial Intelligence for Space Applications May 1990 p 69-84 (For primary document see N90-27275 21-61)
Avail: NTIS HC A25/MF A04 CSCL 09B

In the design of real time systems the capability for task interruption is often considered essential. The problem of task interruption in knowledge-based domains is examined. It is proposed that task interruption can be often avoided by using appropriate functional architectures and knowledge engineering principles. Situations for which task interruption is indispensable, a preliminary architecture based on priority hierarchies is described. Author

N90-27285*# Alabama Univ., Tuscaloosa. Dept. of Computer Science.
KNOWLEDGE REPRESENTATION FOR COMMONALITY
Dorian P. Yeager *In* NASA, Marshall Space Flight Center, Fifth Conference on Artificial Intelligence for Space Applications May 1990 p 85-94 (For primary document see N90-27275 21-61)
(Grants NAG8-718; NGT-01-002-099)
Avail: NTIS HC A25/MF A04 CSCL 09B

Domain-specific knowledge necessary for commonality analysis falls into two general classes: commonality constraints and costing information. Notations for encoding such knowledge should be powerful and flexible and should appeal to the domain expert. The notations employed by the Commonality Analysis Problem Solver (CAPS) analysis tool are described. Examples are given to illustrate the main concepts. Author

N90-27286*# Boeing Computer Support Services, Inc., Huntsville, AL. Artificial Intelligence Center.
A KNOWLEDGE-BASED APPROACH TO CONFIGURATION LAYOUT, JUSTIFICATION, AND DOCUMENTATION
F. G. Craig, D. E. Cutts, T. R. Fennel, C. Case, and J. R. Palmer (Boeing Aerospace Co., Huntsville, AL.) *In* NASA, Marshall Space Flight Center, Fifth Conference on Artificial Intelligence for Space Applications May 1990 p 95-101 (For primary document see N90-27275 21-61)
Avail: NTIS HC A25/MF A04 CSCL 09B

The design, development, and implementation is described of a prototype expert system which could aid designers and system engineers in the placement of racks aboard modules on Space Station Freedom. This type of problem is relevant to any program with multiple constraints and requirements demanding solutions which minimize usage of limited resources. This process is generally performed by a single, highly experienced engineer who integrates all the diverse mission requirements and limitations, and develops an overall technical solution which meets program and system requirements with minimal cost, weight, volume, power, etc. This system architect performs an intellectual integration process in which the underlying design rationale is often not fully documented. This is a situation which lends itself to an expert system solution for enhanced consistency, thoroughness, documentation, and change assessment capabilities. Author

N90-27287*# Cincinnati Univ., OH. Dept. of Electrical and Computer Engineering.
KIPSE1: A KNOWLEDGE-BASED INTERACTIVE PROBLEM SOLVING ENVIRONMENT FOR DATA ESTIMATION AND PATTERN CLASSIFICATION
Chia Yung Han, Liqun Wan, and William G. Wee *In* NASA, Marshall Space Flight Center, Fifth Conference on Artificial

Intelligence for Space Applications May 1990 p 103-111 (For primary document see N90-27275 21-61)
Avail: NTIS HC A25/MF A04 CSCL 09B

A knowledge-based interactive problem solving environment called KIPSE1 is presented. The KIPSE1 is a system built on a commercial expert system shell, the KEE system. This environment gives user capability to carry out exploratory data analysis and pattern classification tasks. A good solution often consists of a sequence of steps with a set of methods used at each step. In KIPSE1, solution is represented in the form of a decision tree and each node of the solution tree represents a partial solution to the problem. Many methodologies are provided at each node to the user such that the user can interactively select the method and data sets to test and subsequently examine the results. Otherwise, users are allowed to make decisions at various stages of problem solving to subdivide the problem into smaller subproblems such that a large problem can be handled and a better solution can be found. Author

N90-27288*# Alabama Univ., Huntsville.
AN ARCHITECTURE FOR RULE BASED SYSTEM EXPLANATION
T. R. Fennel and James D. Johannes *In* NASA, Marshall Space Flight Center, Fifth Conference on Artificial Intelligence for Space Applications May 1990 p 113-120 (For primary document see N90-27275 21-61)
Avail: NTIS HC A25/MF A04 CSCL 09B

A system architecture is presented which incorporate both graphics and text into explanations provided by rule based expert systems. This architecture facilitates explanation of the knowledge base content, the control strategies employed by the system, and the conclusions made by the system. The suggested approach combines hypermedia and inference engine capabilities. Advantages include: closer integration of user interface, explanation system, and knowledge base; the ability to embed links to deeper knowledge underlying the compiled knowledge used in the knowledge base; and allowing for more direct control of explanation depth and duration by the user. User models are suggested to control the type, amount, and order of information presented. Author

N90-27289*# University of Southwestern Louisiana, Lafayette. Center for Advanced Computer Studies.
AN AUTOMATED TOOL FOR THE DESIGN AND ASSESSMENT OF SPACE SYSTEMS
Lois M. L. Dalcambre and Steve P. Landry *In* NASA, Marshall Space Flight Center, Fifth Conference on Artificial Intelligence for Space Applications May 1990 p 121-127 (For primary document see N90-27275 21-61)
Avail: NTIS HC A25/MF A04 CSCL 09B

Space systems can be characterized as both large and complex but they often rely on reusable subcomponents. One problem in the design of such systems is the representation and validation of the system, particularly at the higher levels of management. An automated tool is described for the representation, refinement, and validation of such complex systems based on a formal design theory, the Theory of Plausible Design. In particular, the steps necessary to automate the tool and make it a competent, usable assistant, are described. Author

N90-27290*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, AL.
ATS DISPLAYS: A REASONING VISUALIZATION TOOL FOR EXPERT SYSTEMS
William John Selig and James D. Johannes (Alabama Univ., Huntsville.) *In its* Fifth Conference on Artificial Intelligence for Space Applications May 1990 p 129-138 (For primary document see N90-27275 21-61)
Avail: NTIS HC A25/MF A04 CSCL 09B

Reasoning visualization is a useful tool that can help users better understand the inherently non-sequential logic of an expert system. While this is desirable in most all expert system applications, it is especially so for such critical systems as those destined for space-based operations. A hierarchical view of the expert system reasoning process and some characteristics of these various levels is presented. Also presented are Abstract Time Slice (ATS) displays, a tool to visualize the plethora of interrelated information available at the host inferencing language level of reasoning. The usefulness of this tool is illustrated with some examples from a prototype potable water expert system for possible use aboard Space Station Freedom. Author

N90-27291*# Alabama Univ., Huntsville.
ESTABLISHING A COMMUNICATIONS-INTENSIVE NETWORK TO RESOLVE ARTIFICIAL INTELLIGENCE ISSUES WITHIN NASA'S SPACE STATION FREEDOM RESEARCH CENTERS COMMUNITY **c63**
E. Davis Howard, III *In* NASA, Marshall Space Flight Center, Fifth Conference on Artificial Intelligence for Space Applications May 1990 p 139-145 (For primary document see N90-27275 21-61)
(Contract NAS8-36955)
Avail: NTIS HC A25/MF A04 CSCL 09B

MITRE Corporation's, A Review of Space Station Freedom Program Capabilities for the Development and Application of Advanced Automation, cites as a critical issue the following situation, extant at the NASA facilities visited in the course of preparing the review: The major issues noted with regard to design and research facilities deal with cooperative problem solving, technology transfer, and communication between these facilities. While the authors were visiting lab and test beds to collect information, personnel at many of these facilities were interested in any information they could collect on activities at other facilities. A formal means of gathering this information could not be identified by these personnel. While communication between some facilities was taking place or was planned, for technology transfer or coordination of schedules (e.g., for SADP demonstrations), poor communication between these facilities could lead to a lack of technical standards, duplication of effort, poorly defined interfaces, scheduling problems, and increased cost. Formal mechanisms by which effective communication and cooperative problem solving can take place, and information can be disseminated, must be defined. A solution is proposed for the communications aspects of the issues addressed above; and offered at the same time a solution which can prove effective in dealing with some of the problems being encountered with expertise being lost via retirement or defection to the private sector. The proffered recommendations are recognizably cost-effective and tap the rising sector of expert knowledge being produced by the American academic community. Author

N90-27292*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, MD.
EXPERT SYSTEM DEVELOPMENT METHODOLOGY (ESDM)
Charisse Sary, Lewey Gilstrap (Computer Sciences Corp., Beltsville, MD.), and Larry G. Hull *In* NASA, Marshall Space Flight Center, Fifth Conference on Artificial Intelligence for Space Applications May 1990 p 147-154 (For primary document see N90-27275 21-61)
(Contract NAS5-31500)
Avail: NTIS HC A25/MF A04 CSCL 09B

The Expert System Development Methodology (ESDM) provides an approach to developing expert system software. Because of the uncertainty associated with this process, an element of risk is involved. ESDM is designed to address the issue of risk and to acquire the information needed for this purpose in an evolutionary manner. ESDM presents a life cycle in which a prototype evolves through five stages of development. Each stage consists of five steps, leading to a prototype for that stage. Development may proceed to a conventional development methodology (CDM) at any time if enough has been learned about the problem to write requirements. ESDM produces requirements so that a product may be built with a CDM. ESDM is considered preliminary because is has not yet been applied to actual projects. It has been retrospectively evaluated by comparing the methods used in two ongoing expert system development projects that did not explicitly

choose to use this methodology but which provided useful insights into actual expert system development practices and problems.
Author

N90-27293*# Rockwell International Corp., Canoga Park, CA. Rocketdyne Div.
A HYBRID APPROACH TO SPACE POWER CONTROL **c20**
E. W. Gholdston, D. F. Janik, and K. A. Newton *In* NASA, Marshall Space Flight Center, Fifth Conference on Artificial Intelligence for Space Applications May 1990 p 155-163 (For primary document see N90-27275 21-61)
Avail: NTIS HC A25/MF A04 CSCL 10C

Conventional control systems have traditionally been utilized for space-based power designs. However, the use of expert systems is becoming important for NASA applications. Rocketdyne has been pursuing the development of expert systems to aid and enhance control designs of space-based power systems. The need for integrated expert systems is vital for the development of autonomous power systems.
Author

N90-27294*# Vanderbilt Univ., Nashville, TN.
A STUDY ON DIAGNOSABILITY OF SPACE STATION ECLSS **c54**
S. Padalkar, W. Blokland, and J. Sztipanovits *In* NASA, Marshall Space Flight Center, Fifth Conference on Artificial Intelligence for Space Applications May 1990 p 165-174 Sponsored in part by Boeing Aerospace Co., Huntsville, AL (For primary document see N90-27275 21-61)
Avail: NTIS HC A25/MF A04 CSCL 06K

The use is demonstrated of the Multigraph Architecture (MGA) for studies on the Environment Control and Life Support System (ECLSS). The objective was the following: (1) to create an updated set of models of the Potable Water Subsystem (PWS) by using the graphical model building tools of the Multigraph Programming Environment (MPE); (2) to derive a real time alarm simulator from the models; and (3) to demonstrate the effects of sensor allocation on the diagnosability of the PWS. This work may serve as a preliminary study for the detailed analysis of the sensor allocation and diagnosability problems in the ECLSS.
Author

N90-27295*# Honeywell, Inc., Minneapolis, MN. Systems and Research Center.
ATTITUDE DETERMINATION AND CONTROL SYSTEM (ADCS) AND MAINTENANCE AND DIAGNOSTIC SYSTEM (MDS): A MAINTENANCE AND DIAGNOSTIC SYSTEM FOR SPACE STATION FREEDOM **c18**
David Toms, George D. Hadden, and Jim Harrington (Honeywell, Inc., Clearwater, FL.) *In* NASA, Marshall Space Flight Center, Fifth Conference on Artificial Intelligence for Space Applications May 1990 p 175-183 Sponsored in part by McDonnell-Douglas Space Systems Co. (For primary document see N90-27275 21-61)
(Contract NAS9-18200)
Avail: NTIS HC A25/MF A04 CSCL 22B

The Maintenance and Diagnostic System (MDS) that is being developed at Honeywell to enhance the Fault Detection Isolation and Recovery system (FDIR) for the Attitude Determination and Control System on Space Station Freedom is described. The MDS demonstrates ways that AI-based techniques can be used to improve the maintainability and safety of the Station by helping to resolve fault anomalies that cannot be fully determined by built-in-test, by providing predictive maintenance capabilities, and by providing expert maintenance assistance. The MDS will address the problems associated with reasoning about dynamic, continuous information versus only about static data, the concerns of porting software based on AI techniques to embedded targets, and the difficulties associated with real-time response. An initial prototype was built of the MDS. The prototype executes on Sun and IBM PS/2 hardware and is implemented in the Common Lisp; further work will evaluate its functionality and develop mechanisms to port the code to Ada.
Author

N90-27296*# National Aeronautics and Space Administration, Washington, DC.
KNOWLEDGE-BASED SYSTEMS AND NASA'S SOFTWARE SUPPORT ENVIRONMENT
Tim Dugan, Cora Carmody, Kent Lennington (Lockheed Missiles and Space Co., Houston, TX.), and Bob Nelson *In* NASA, Marshall Space Flight Center, Fifth Conference on Artificial Intelligence for Space Applications May 1990 p 185-192 (For primary document see N90-27275 21-61)
Avail: NTIS HC A25/MF A04 CSCL 09B

A proposed role for knowledge-based systems within NASA's Software Support Environment (SSE) is described. The SSE is chartered to support all software development for the Space Station Freedom Program (SSFP). This includes support for development of knowledge-based systems and the integration of these systems with conventional software systems. In addition to the support of development of knowledge-based systems, various software development functions provided by the SSE will utilize knowledge-based systems technology.
Author

N90-27297*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, AL.
SPACE STATION FREEDOM ECLSS: A STEP TOWARD AUTONOMOUS REGENERATIVE LIFE SUPPORT SYSTEMS **c54**
Brandon S. Dewberry *In its* Fifth Conference on Artificial Intelligence for Space Applications May 1990 p 193-201 (For primary document see N90-27275 21-61)
Avail: NTIS HC A25/MF A04 CSCL 06K

The Environmental Control and Life Support System (ECLSS) is a Freedom Station distributed system with inherent applicability to extensive automation primarily due to its comparatively long control system latencies. These allow longer contemplation times in which to form a more intelligent control strategy and to prevent and diagnose faults. The regenerative nature of the Space Station Freedom ECLSS will contribute closed loop complexities never before encountered in life support systems. A study to determine ECLSS automation approaches has been completed. The ECLSS baseline software and system processes could be augmented with more advanced fault management and regenerative control systems for a more autonomous evolutionary system, as well as serving as a firm foundation for future regenerative life support systems. Emerging advanced software technology and tools can be successfully applied to fault management, but a fully automated life support system will require research and development of regenerative control systems and models. The baseline Environmental Control and Life Support System utilizes ground tests in development of batch chemical and microbial control processes. Long duration regenerative life support systems will require more active chemical and microbial feedback control systems which, in turn, will require advancements in regenerative life support models and tools. These models can be verified using ground and on orbit life support test and operational data, and used in the engineering analysis of proposed intelligent instrumentation feedback and flexible process control technologies for future autonomous regenerative life support systems, including the evolutionary Space Station Freedom ECLSS.
Author

N90-27298*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, AL.
SIMULATION-BASED INTELLIGENT ROBOTIC AGENT FOR SPACE STATION FREEDOM **c54**
Csaba A. Biegl, James F. Springfield, George E. Cook, and Kenneth R. Fernandez (Vanderbilt Univ., Nashville, TN.) *In its* Fifth Conference on Artificial Intelligence for Space Applications May 1990 p 203-210 (For primary document see N90-27275 21-61)
Avail: NTIS HC A25/MF A04 CSCL 05H

A robot control package is described which utilizes on-line structural simulation of robot manipulators and objects in their workspace. The model-based controller is interfaced with a high level agent-independent planner, which is responsible for the task-level planning of the robot's actions. Commands received

from the agent-independent planner are refined and executed in the simulated workspace, and upon successful completion, they are transferred to the real manipulators. Author

N90-27299*# Boeing Computer Support Services, Inc., Huntsville, AL. Artificial Intelligence Center.

GRAPHICAL EXPLANATION IN AN EXPERT SYSTEM FOR SPACE STATION FREEDOM RACK INTEGRATION **c18**

F. G. Craig, D. E. Cutts, T. R. Fennel, and B. Purves (Boeing Aerospace Co., Huntsville, AL.) *In* NASA, Marshall Space Flight Center, Fifth Conference on Artificial Intelligence for Space Applications May 1990 p 211-219 (For primary document see N90-27275 21-61)

Avail: NTIS HC A25/MF A04 CSCL 22B

The rationale and methodology used to incorporate graphics into explanations provided by an expert system for Space Station Freedom rack integration is examined. The rack integration task is typical of a class of constraint satisfaction problems for large programs where expertise from several areas is required. Graphically oriented approaches are used to explain the conclusions made by the system, the knowledge base content, and even at more abstract levels the control strategies employed by the system. The implemented architecture combines hypermedia and inference engine capabilities. The advantages of this architecture include: closer integration of user interface, explanation system, and knowledge base; the ability to embed links to deeper knowledge underlying the compiled knowledge used in the knowledge base; and allowing for more direct control of explanation depth and duration by the user. The graphical techniques employed range from simple statis presentation of schematics to dynamic creation of a series of pictures presented motion picture style. User models control the type, amount, and order of information presented. Author

N90-27300*# McDonnell-Douglas Space Systems Co., Houston, TX.

SPACE STATION ADVANCED AUTOMATION **c18**

Donald Woods *In* NASA, Marshall Space Flight Center, Fifth Conference on Artificial Intelligence for Space Applications May 1990 p 221-230 (For primary document see N90-27275 21-61)

(Contract NAS9-18200)

Avail: NTIS HC A25/MF A04 CSCL 22B

In the development of a safe, productive and maintainable space station, Automation and Robotics (A and R) has been identified as an enabling technology which will allow efficient operation at a reasonable cost. The Space Station Freedom's (SSF) systems are very complex, and interdependent. The usage of Advanced Automation (AA) will help restructure, and integrate system status so that station and ground personnel can operate more efficiently. To use AA technology for the augmentation of system management functions requires a development model which consists of well defined phases of: evaluation, development, integration, and maintenance. The evaluation phase will consider system management functions against traditional solutions, implementation techniques and requirements; the end result of this phase should be a well developed concept along with a feasibility analysis. In the development phase the AA system will be developed in accordance with a traditional Life Cycle Model (LCM) modified for Knowledge Based System (KBS) applications. A way by which both knowledge bases and reasoning techniques can be reused to control costs is explained. During the integration phase the KBS software must be integrated with conventional software, and verified and validated. The Verification and Validation (V and V) techniques applicable to these KBS are based on the ideas of consistency, minimal competency, and graph theory. The maintenance phase will be aided by having well designed and documented KBS software. Author

N90-27301*# Symbolics, Inc., Cambridge, MA.

A DEVELOPMENT FRAMEWORK FOR ARTIFICIAL INTELLIGENCE BASED DISTRIBUTED OPERATIONS SUPPORT SYSTEMS **c63**

Richard M. Adler and Bruce H. Cottman *In* NASA, Marshall Space Flight Center, Fifth Conference on Artificial Intelligence for Space Applications May 1990 p 231-240 (For primary document see N90-27275 21-61)

(Contracts NAS10-11606; DAAB10-87-C-0053)

Avail: NTIS HC A25/MF A04 CSCL 09B

Advanced automation is required to reduce costly human operations support requirements for complex space-based and ground control systems. Existing knowledge based technologies have been used successfully to automate individual operations tasks. Considerably less progress has been made in integrating and coordinating multiple operations applications for unified intelligent support systems. To fill this gap, SOCIAL, a tool set for developing Distributed Artificial Intelligence (DAI) systems is being constructed. SOCIAL consists of three primary language based components defining: models of interprocess communication across heterogeneous platforms; models for interprocess coordination, concurrency control, and fault management; and for accessing heterogeneous information resources. DAI applications subsystems, either new or existing, will access these distributed services non-intrusively, via high-level message-based protocols. SOCIAL will reduce the complexity of distributed communications, control, and integration, enabling developers to concentrate on the design and functionality of the target DAI system itself. Author

N90-27302*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, AL.

A KNOWLEDGE BASE ARCHITECTURE FOR DISTRIBUTED KNOWLEDGE AGENTS **c63**

Joel Riedesel (Martin Marietta Corp., Huntsville, AL.) and Bryan Walls *In its* Fifth Conference on Artificial Intelligence for Space Applications May 1990 p 241-256 (For primary document see N90-27275 21-61)

(Contract NAS8-36433)

Avail: NTIS HC A25/MF A04 CSCL 09B

A tuple space based object oriented model for knowledge base representation and interpretation is presented. An architecture for managing distributed knowledge agents is then implemented within the model. The general model is based upon a database implementation of a tuple space. Objects are then defined as an additional layer upon the database. The tuple space may or may not be distributed depending upon the database implementation. A language for representing knowledge and inference strategy is defined whose implementation takes advantage of the tuple space. The general model may then be instantiated in many different forms, each of which may be a distinct knowledge agent. Knowledge agents may communicate using tuple space mechanisms as in the LINDA model as well as using more well known message passing mechanisms. An implementation of the model is presented describing strategies used to keep inference tractable without giving up expressivity. An example applied to a power management and distribution network for Space Station Freedom is given. Author

N90-27303*# Mitre Corp., McLean, VA. Artificial Intelligence Technical Center.

CREATURE CO-OP: ACHIEVING ROBUST REMOTE OPERATIONS WITH A COMMUNITY OF LOW-COST ROBOTS **c54**

R. Peter Bonasso *In* NASA, Marshall Space Flight Center, Fifth Conference on Artificial Intelligence for Space Applications May 1990 p 257-269 (For primary document see N90-27275 21-61)

Avail: NTIS HC A25/MF A04 CSCL 05H

The concept is advanced of carrying out space based remote missions using a cooperative of low cost robot specialists rather than monolithic, multipurpose systems. A simulation is described wherein a control architecture for such a system of specialists is being investigated. Early results show such co-ops to be robust in the face of unforeseen circumstances. Descriptions of the platforms and sensors modeled and the beacon and retriever creatures that make up the co-op are included. Author

N90-27304*# Boeing Computer Services Co., Seattle, WA. Advanced Technology Center.
DESIGN KNOWLEDGE CAPTURE FOR A CORPORATE MEMORY FACILITY **c60**
John H. Boose, David B. Sherna, and Jeffrey M. Bradshaw *In* NASA, Marshall Space Flight Center, Fifth Conference on Artificial Intelligence for Space Applications May 1990 p 271-280 (For primary document see N90-27275 21-61)
Avail: NTIS HC A25/MF A04 CSCL 09B

Currently, much of the information regarding decision alternatives and trade-offs made in the course of a major program development effort is not represented or retained in a way that permits computer-based reasoning over the life cycle of the program. The loss of this information results in problems in tracing design alternatives to requirements, in assessing the impact of change in requirements, and in configuration management. To address these problems, the problem was studied of building an intelligent, active corporate memory facility which would provide for the capture of the requirements and standards of a program, analyze the design alternatives and trade-offs made over the program's lifetime, and examine relationships between requirements and design trade-offs. Early phases of the work have concentrated on design knowledge capture for the Space Station Freedom. Tools are demonstrated and extended which helps automate and document engineering trade studies, and another tool is being developed to help designers interactively explore design alternatives and constraints. Author

N90-27305*# University of Southwestern Louisiana, Lafayette. Center for Advanced Computer Studies.
CAPTURING DESIGN KNOWLEDGE
Brian A. Babin and Rasiah Loganantharaj *In* NASA, Marshall Space Flight Center, Fifth Conference on Artificial Intelligence for Space Applications May 1990 p 281-290 (For primary document see N90-27275 21-61)
Avail: NTIS HC A25/MF A04 CSCL 09B

A scheme is proposed to capture the design knowledge of a complex object including functional, structural, performance, and other constraints. Further, the proposed scheme is also capable of capturing the rationale behind the design of an object as a part of the overall design of the object. With this information, the design of an object can be treated as a case and stored with other designs in a case base. A person can then perform case-based reasoning by examining these designs. Methods of modifying object designs are also discussed. Finally, an overview of an approach to fault diagnosis using case-based reasoning is given. Author

N90-27306*# Lockheed Missiles and Space Co., Sunnyvale, CA.
AN APPLICATION OF DESIGN KNOWLEDGE CAPTURED FROM MULTIPLE SOURCES
Preston A. Cox and John H. Forbes *In* NASA, Marshall Space Flight Center, Fifth Conference on Artificial Intelligence for Space Applications May 1990 p 291-300 (For primary document see N90-27275 21-61)
(Contract NAS8-32697)
Avail: NTIS HC A25/MF A04 CSCL 09B

The Hubble Space Telescope Operational Readiness Expert Safemode Investigation System (HSTORESIS) is a reusable knowledge base shell used to demonstrate the integration and application of design knowledge captured from multiple technical domains. The design of HSTORESIS is based on a partitioning of knowledge to maximize the potential for reuse of certain types of knowledge. Author

N90-27307*# University of Western Kentucky, Bowling Green. Dept. of Computer Science.
THE INTEGRATION OF AUTOMATED KNOWLEDGE ACQUISITION WITH COMPUTER-AIDED SOFTWARE ENGINEERING FOR SPACE SHUTTLE EXPERT SYSTEMS
Kenneth L. Modesitt *In* NASA, Marshall Space Flight Center, Fifth Conference on Artificial Intelligence for Space Applications May 1990 p 301-304 (For primary document see N90-27275 21-61)
Avail: NTIS HC A25/MF A04 CSCL 09B

A prediction was made that the terms expert systems and knowledge acquisition would begin to disappear over the next several years. This is not because they are falling into disuse; it is rather that practitioners are realizing that they are valuable adjuncts to software engineering, in terms of problem domains addressed, user acceptance, and in development methodologies. A specific problem was discussed, that of constructing an automated test analysis system for the Space Shuttle Main Engine. In this domain, knowledge acquisition was part of requirements systems analysis, and was performed with the aid of a powerful inductive ESBT in conjunction with a computer aided software engineering (CASE) tool. The original prediction is not a very risky one -- it has already been accomplished. Author

N90-27308*# Martin Marietta Corp., New Orleans, LA.
CASE-BASED REASONING IN DESIGN: AN APOLOGIA
Kirt Pulaski *In* NASA, Marshall Space Flight Center, Fifth Conference on Artificial Intelligence for Space Applications May 1990 p 305-314 (For primary document see N90-27275 21-61)
Avail: NTIS HC A25/MF A04 CSCL 09B

Three positions are presented and defended: the process of generating solutions in problem solving is viewable as a design task; case-based reasoning is a strong method of problem solving; and a synergism exists between case-based reasoning and design problem solving. Author

N90-27309*# SENTAR, Inc., Huntsville, AL.
ARTIFICIAL INTELLIGENCE SOFTWARE ENGINEERING (AISE) MODEL Abstract Only
Peter A. Kiss *In* NASA, Marshall Space Flight Center, Fifth Conference on Artificial Intelligence for Space Applications May 1990 p 315 (For primary document see N90-27275 21-61)
Avail: NTIS HC A25/MF A04 CSCL 09B

The American Institute of Aeronautics and Astronautics has initiated a committee on standards for Artificial Intelligence. Presented are the initial efforts of one of the working groups of that committee. A candidate model is presented for the development life cycle of knowledge based systems (KBSs). The intent is for the model to be used by the aerospace community and eventually be evolved into a standard. The model is rooted in the evolutionary model, borrows from the spiral model, and is embedded in the standard Waterfall model for software development. Its intent is to satisfy the development of both stand-alone and embedded KBSs. The phases of the life cycle are shown and detailed as are the review points that constitute the key milestones throughout the development process. The applicability and strengths of the model are discussed along with areas needing further development and refinement by the aerospace community. Author

N90-27310*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, AL.
DETECTING PERCEPTUAL GROUPINGS IN TEXTURES BY CONTINUITY CONSIDERATIONS
Richard J. Greene *In its* Fifth Conference on Artificial Intelligence for Space Applications May 1990 p 317-323 (For primary document see N90-27275 21-61)
Avail: NTIS HC A25/MF A04 CSCL 09B

A generalization is presented for the second derivative of a Gaussian D(sup 2)G operator to apply to problems of perceptual organization involving textures. Extensions to other problems of perceptual organization are evident and a new research direction can be established. The technique presented is theoretically pleasing since it has the potential of unifying the entire area of image segmentation under the mathematical notion of continuity and presents a single algorithm to form perceptual groupings where many algorithms existed previously. The eventual impact on both the approach and technique of image processing segmentation operations could be significant. Author

N90-27311*# Boeing Aerospace Co., Huntsville, AL. Advanced Civil Space Systems.

A VISION-BASED TELEROBOTIC CONTROL STATION c54

Brian Tillotson *In* NASA, Marshall Space Flight Center, Fifth Conference on Artificial Intelligence for Space Applications May 1990 p 325-329 (For primary document see N90-27275 21-61)

Avail: NTIS HC A25/MF A04 CSCL 05H

A telerobotic control station is described. In it, a machine vision system measures the position, orientation, and configuration of a user's hand. A robotic manipulator mirrors the status of the hand. This concept has two benefits: control actions are intuitive and easily learned, and the workstation requires little volume or mass. Author

N90-27312*# Scientific Research Associates, Inc., Glastonbury, CT.

THE REAL-TIME LEARNING MECHANISM OF THE SCIENTIFIC RESEARCH ASSOCIATES ADVANCED ROBOTIC SYSTEM (SRAARS) c63

Alexander Y. Chen *In* NASA, Marshall Space Flight Center, Fifth Conference on Artificial Intelligence for Space Applications May 1990 p 331-340 (For primary document see N90-27275 21-61)

(Contract NAS7-1012)

Avail: NTIS HC A25/MF A04 CSCL 09B

Scientific research associates advanced robotic system (SRAARS) is an intelligent robotic system which has autonomous learning capability in geometric reasoning. The system is equipped with one global intelligence center (GIC) and eight local intelligence centers (LICs). It controls mainly sixteen links with fourteen active joints, which constitute two articulated arms, an extensible lower body, a vision system with two CCD cameras and a mobile base. The on-board knowledge-based system supports the learning controller with model representations of both the robot and the working environment. By consecutive verifying and planning procedures, hypothesis-and-test routines and learning-by-analogy paradigm, the system would autonomously build up its own understanding of the relationship between itself (i.e., the robot) and the focused environment for the purposes of collision avoidance, motion analysis and object manipulation. The intelligence of SRAARS presents a valuable technical advantage to implement robotic systems for space exploration and space station operations. Author

N90-27313*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.

A DIAGNOSIS SYSTEM USING OBJECT-ORIENTED FAULT TREE MODELS

David L. Iverson and F. A. Patterson-Hine *In* NASA, Marshall Space Flight Center, Fifth Conference on Artificial Intelligence for Space Applications May 1990 p 341-349 (For primary document see N90-27275 21-61)

Avail: NTIS HC A25/MF A04 CSCL 09B

Spaceborne computing systems must provide reliable, continuous operation for extended periods. Due to weight, power, and volume constraints, these systems must manage resources very effectively. A fault diagnosis algorithm is described which enables fast and flexible diagnoses in the dynamic distributed computing environments planned for future space missions. The algorithm uses a knowledge base that is easily changed and updated to reflect current system status. Augmented fault trees represented in an object-oriented form provide deep system knowledge that is easy to access and revise as a system changes. Given such a fault tree, a set of failure events that have occurred, and a set of failure events that have not occurred, this diagnosis system uses forward and backward chaining to propagate causal and temporal information about other failure events in the system being diagnosed. Once the system has established temporal and causal constraints, it reasons backward from heuristically selected failure events to find a set of basic failure events which are a likely cause of the occurrence of the top failure event in the fault tree. The diagnosis system has been implemented in common LISP using Flavors. Author

N90-27314*# Rockwell International Corp., Downey, CA. Space Transportation Systems Div.

A MODEL FOR A SPACE SHUTTLE SAFING AND FAILURE-DETECTION EXPERT c54

Daphna Zeilingold and John Hoey *In* NASA, Marshall Space Flight Center, Fifth Conference on Artificial Intelligence for Space Applications May 1990 p 351-359 (For primary document see N90-27275 21-61)

Avail: NTIS HC A25/MF A04 CSCL 06K

The safing and failure-detection expert (SAFE) is a prototype for a malfunction detection, diagnosis, and safing system for the atmospheric revitalization subsystem (ARS) in the Space Shuttle orbiter. SAFE, whose knowledge was extracted from expert-provided heuristics and documented procedures, automatically manages all phases of failure handling: detection, diagnosis, testing procedures, and recovery instructions. The SAFE architecture allows it to handle correctly sensor failures and multiple malfunctions. Since SAFE is highly interactive, it was used as a test bed for the evaluation of various advanced human-computer interface (HCI) techniques. The use of such expert systems in the next generation of space vehicles would increase their reliability and autonomy to levels not achievable before. Author

N90-27315*# Alabama Univ., Huntsville.

OBJECT ORIENTED FAULT DIAGNOSIS SYSTEM FOR SPACE SHUTTLE MAIN ENGINE REDLINES

John S. Rogers and Saroj Kumar Mohapatra *In* NASA, Marshall Space Flight Center, Fifth Conference on Artificial Intelligence for Space Applications May 1990 p 361-372 (For primary document see N90-27275 21-61)

Avail: NTIS HC A25/MF A04 CSCL 09B

A great deal of attention has recently been given to Artificial Intelligence research in the area of computer aided diagnostics. Due to the dynamic and complex nature of space shuttle red-line parameters, a research effort is under way to develop a real time diagnostic tool that will employ historical and engineering rulebases as well as a sensor validity checking. The capability of AI software development tools (KEE and G2) will be explored by applying object oriented programming techniques in accomplishing the diagnostic evaluation. Author

N90-27316*# Boeing Aerospace Co., Huntsville, AL.

AN APPLICATION GENERATOR FOR RAPID PROTOTYPING OF Ada REAL-TIME CONTROL SOFTWARE

Jim Johnson, Haik Biglari, and Larry Lehman (Integrated Systems, Inc., Santa Clara, CA.) *In* NASA, Marshall Space Flight Center, Fifth Conference on Artificial Intelligence for Space Applications May 1990 p 373-381 Previously announced in IAA as A90-10623 (For primary document see N90-27275 21-61)

Avail: NTIS HC A25/MF A04 CSCL 09B

The need to increase engineering productivity and decrease software life cycle costs in real-time system development establishes a motivation for a method of rapid prototyping. The design by iterative rapid prototyping technique is described. A tool which facilitates such a design methodology for the generation of embedded control software is described. Author

N90-27317*# University of Central Michigan, Mount Pleasant. Dept. of Computer Science.

AN ENGINEERING APPROACH TO AUTOMATIC PROGRAMMING

Stuart H. Rubin *In* NASA, Marshall Space Flight Center, Fifth Conference on Artificial Intelligence for Space Applications May 1990 p 383-391 Sponsored in part by Office of Naval Technology, Washington, DC (For primary document see N90-27275 21-61)

Avail: NTIS HC A25/MF A04 CSCL 09B

An exploratory study of the automatic generation and optimization of symbolic programs using DECOM - a prototypical requirement specification model implemented in pure LISP was

undertaken. It was concluded, on the basis of this study, that symbolic processing languages such as LISP can support a style of programming based upon formal transformation and dependent upon the expression of constraints in an object-oriented environment. Such languages can represent all aspects of the software generation process (including heuristic algorithms for effecting parallel search) as dynamic processes since data and program are represented in a uniform format. Author

N90-27318*# University of Central Michigan, Mount Pleasant. Dept. of Computer Engineering.
AUTOMATED EXTRACTION OF KNOWLEDGE FOR MODEL-BASED DIAGNOSTICS **c82**
Avelino J. Gonzalez, Harley R. Myler, Massood Towhidnejad, Frederic D. McKenzie, and Robin R. Kladke *In* NASA, Marshall Space Flight Center, Fifth Conference on Artificial Intelligence for Space Applications May 1990 p 393-401 (For primary document see N90-27275 21-61)
(Grant NAG10-0043)
Avail: NTIS HC A25/MF A04 CSCL 05B

The concept of accessing computer aided design (CAD) design databases and extracting a process model automatically is investigated as a possible source for the generation of knowledge bases for model-based reasoning systems. The resulting system, referred to as automated knowledge generation (AKG), uses an object-oriented programming structure and constraint techniques as well as internal database of component descriptions to generate a frame-based structure that describes the model. The procedure has been designed to be general enough to be easily coupled to CAD systems that feature a database capable of providing label and connectivity data from the drawn system. The AKG system is capable of defining knowledge bases in formats required by various model-based reasoning tools. Author

N90-27319*# QTC Horizon Labs., Beaverton, OR.
DERIVATION OF SORTING PROGRAMS
Joseph Varghese and Rasiah Loganantharaj (University of Southwestern Louisiana, Lafayette.) *In* NASA, Marshall Space Flight Center, Fifth Conference on Artificial Intelligence for Space Applications May 1990 p 403-420 (For primary document see N90-27275 21-61)
Avail: NTIS HC A25/MF A04 CSCL 09B

Program synthesis for critical applications has become a viable alternative to program verification. Nested resolution and its extension are used to synthesize a set of sorting programs from their first order logic specifications. A set of sorting programs, such as, naive sort, merge sort, and insertion sort, were successfully synthesized starting from the same set of specifications. Author

N90-27320*# Army Missile Command, Redstone Arsenal, AL. Systems Simulation and Development Directorate.
A STRUCTURE FOR MATURING INTELLIGENT TUTORING SYSTEM STUDENT MODELS **c63**
Willard M. Holmes *In* NASA, Marshall Space Flight Center, Fifth Conference on Artificial Intelligence for Space Applications May 1990 p 421-428 (For primary document see N90-27275 21-61)
Avail: NTIS HC A25/MF A04 CSCL 09B

A special structure is examined for evolving a detached model of the user of an intelligent tutoring system. Tutoring is used in the context of education and training devices. A detached approach to populating the student model data structure is examined in the context of the need for time dependent reasoning about what the student knows about a particular concept in the domain of interest. This approach, to generating a data structure for the student model, allows an inference engine separate from the tutoring strategy determination to be used. This methodology has advantages in environments requiring real-time operation. Author

N90-27321*# FMC Corp., Santa Clara, CA. Knowledge Systems Research.
A TOOL FOR MODELING CONCURRENT REAL-TIME COMPUTATION
D. D. Sharma, Shie-Rei Huang, Rahul Bhatt, and N. S. Sridharan *In* NASA, Marshall Space Flight Center, Fifth Conference on Artificial Intelligence for Space Applications May 1990 p 429-438 (For primary document see N90-27275 21-61)
Avail: NTIS HC A25/MF A04 CSCL 09B

Real-time computation is a significant area of research in general, and in AI in particular. The complexity of practical real-time problems demands use of knowledge-based problem solving techniques while satisfying real-time performance constraints. Since the demands of a complex real-time problem cannot be predicted (owing to the dynamic nature of the environment) powerful dynamic resource control techniques are needed to monitor and control the performance. A real-time computation model for a real-time tool, an implementation of the QP-Net simulator on a Symbolics machine, and an implementation on a Butterfly multiprocessor machine are briefly described. Author

N90-27322*# Advanced Technology, Inc., Huntsville, AL.
CONSTRUCTION OF DYNAMIC STOCHASTIC SIMULATION MODELS USING KNOWLEDGE-BASED TECHNIQUES
M. Douglas Williams and Sajjan G. Shiva (Alabama Univ., Huntsville.) *In* NASA, Marshall Space Flight Center, Fifth Conference on Artificial Intelligence for Space Applications May 1990 p 439-455 (For primary document see N90-27275 21-61)
Avail: NTIS HC A25/MF A04 CSCL 09B

Over the past three decades, computer-based simulation models have proven themselves to be cost-effective alternatives to the more structured deterministic methods of systems analysis. During this time, many techniques, tools and languages for constructing computer-based simulation models have been developed. More recently, advances in knowledge-based system technology have led many researchers to note the similarities between knowledge-based programming and simulation technologies and to investigate the potential application of knowledge-based programming techniques to simulation modeling. The integration of conventional simulation techniques with knowledge-based programming techniques is discussed to provide a development environment for constructing knowledge-based simulation models. A comparison of the techniques used in the construction of dynamic stochastic simulation models and those used in the construction of knowledge-based systems provides the requirements for the environment. This leads to the design and implementation of a knowledge-based simulation development environment. These techniques were used in the construction of several knowledge-based simulation models including the Advanced Launch System Model (ALSYM). Author

N90-27323*# Rockwell International Corp., Canoga Park, CA. Rocketdyne Div.
THE COMPOSITE LOAD SPECTRA PROJECT **c39**
J. F. Newell, H. Ho, and R. E. Kurth (Battelle Columbus Labs., OH.) *In* NASA, Marshall Space Flight Center, Fifth Conference on Artificial Intelligence for Space Applications May 1990 p 457-466 (For primary document see N90-27275 21-61)
Avail: NTIS HC A25/MF A04 CSCL 20K

Probabilistic methods and generic load models capable of simulating the load spectra that are induced in space propulsion system components are being developed. Four engine component types (the transfer ducts, the turbine blades, the liquid oxygen posts and the turbopump oxidizer discharge duct) were selected as representative hardware examples. The composite load spectra that simulate the probabilistic loads for these components are typically used as the input loads for a probabilistic structural analysis. The knowledge-based system approach used for the composite load spectra project provides an ideal environment for incremental development. The intelligent database paradigm employed in developing the expert system provides a smooth coupling between the numerical processing and the symbolic (information) processing. Large volumes of engine load information and engineering data are stored in database format and managed by a database management system. Numerical procedures for probabilistic load simulation and database management functions

are controlled by rule modules. Rules were hard-wired as decision trees into rule modules to perform process control tasks. There are modules to retrieve load information and models. There are modules to select loads and models to carry out quick load calculations or make an input file for full duty-cycle time dependent load simulation. The composite load spectra load expert system implemented today is capable of performing intelligent rocket engine load spectra simulation. Further development of the expert system will provide tutorial capability for users to learn from it.
Author

N90-27324*# Southwest Research Inst., San Antonio, TX.
INTELLIGENT TUTORING SYSTEMS FOR SPACE APPLICATIONS **c63**
Carol A. Luckhardt-Redfield *In* NASA, Marshall Space Flight Center, Fifth Conference on Artificial Intelligence for Space Applications May 1990 p 467-475 (For primary document see N90-27275 21-61)
Avail: NTIS HC A25/MF A04 CSCL 09B

Artificial Intelligence has been used in many space applications. Intelligent tutoring systems (ITSs) have only recently been developed for assisting training of space operations and skills. An ITS at Southwest Research Institute is described as an example of an ITS application for space operations, specifically, training console operations at mission control. A distinction is made between critical skills and knowledge versus routine skills. Other ITSs for space are also discussed and future training requirements and potential ITS solutions are described. Author

N90-27325*# Alabama Univ., Huntsville. Dept. of Computer Science.
DOCUMENTATION AND KNOWLEDGE ACQUISITION **c82**
Daniel Rochowiak and Warren Moseley *In* NASA, Marshall Space Flight Center, Fifth Conference on Artificial Intelligence for Space Applications May 1990 p 477-486 (For primary document see N90-27275 21-61)
(Contract NAS8-36955)
Avail: NTIS HC A25/MF A04 CSCL 05B

Traditional approaches to knowledge acquisition have focused on interviews. An alternative focuses on the documentation associated with a domain. Adopting a documentation approach provides some advantages during familiarization. A knowledge management tool was constructed to gain these advantages.
Author

N90-27326*# University of Western Kentucky, Bowling Green. Dept. of Computer Science.
INDUCTIVE KNOWLEDGE ACQUISITION EXPERIENCE WITH COMMERCIAL TOOLS FOR SPACE SHUTTLE MAIN ENGINE TESTING **c82**
Kenneth L. Modesitt *In* NASA, Marshall Space Flight Center, Fifth Conference on Artificial Intelligence for Space Applications May 1990 p 487-496 (For primary document see N90-27275 21-61)
Avail: NTIS HC A25/MF A04 CSCL 05B

Since 1984, an effort has been underway at Rocketdyne, manufacturer of the Space Shuttle Main Engine (SSME), to automate much of the analysis procedure conducted after engine test firings. Previously published articles at national and international conferences have contained the context of and justification for this effort. Here, progress is reported in building the full system, including the extensions of integrating large databases with the system, known as Scotty. Inductive knowledge acquisition has proven itself to be a key factor in the success of Scotty. The combination of a powerful inductive expert system building tool (ExTran), a relational data base management system (Reliance), and software engineering principles and Computer-Assisted Software Engineering (CASE) tools makes for a practical, useful and state-of-the-art application of an expert system. Author

N90-27327*# Aerospace Corp., Los Angeles, CA. Computer Science Lab.
VIP: A KNOWLEDGE-BASED DESIGN AID FOR THE ENGINEERING OF SPACE SYSTEMS
Steven M. Lewis and Kirstie L. Bellman *In* NASA, Marshall Space Flight Center, Fifth Conference on Artificial Intelligence for Space Applications May 1990 p 497-505 (For primary document see N90-27275 21-61)
Avail: NTIS HC A25/MF A04 CSCL 09B

The Vehicles Implementation Project (VIP), a knowledge-based design aid for the engineering of space systems is described. VIP combines qualitative knowledge in the form of rules, quantitative knowledge in the form of equations, and other mathematical modeling tools. The system allows users rapidly to develop and experiment with models of spacecraft system designs. As information becomes available to the system, appropriate equations are solved symbolically and the results are displayed. Users may browse through the system, observing dependencies and the effects of altering specific parameters. The system can also suggest approaches to the derivation of specific parameter values. In addition to providing a tool for the development of specific designs, VIP aims at increasing the user's understanding of the design process. Users may rapidly examine the sensitivity of a given parameter to others in the system and perform tradeoffs or optimizations of specific parameters. A second major goal of VIP is to integrate the existing corporate knowledge base of models and rules into a central, symbolic form. Author

N90-27328*# Missouri Univ., Rolla. Graduate Engineering Center.
USING DECISION-TREE CLASSIFIER SYSTEMS TO EXTRACT KNOWLEDGE FROM DATABASES
D. C. St.Clair, C. L. Sabharwal, Keith Hacke, and W. E. Bond (McDonnell-Douglas Research Labs., Saint Louis, MO.) *In* NASA, Marshall Space Flight Center, Fifth Conference on Artificial Intelligence for Space Applications May 1990 p 507-516 Sponsored in part by McDonnell-Douglas Independent Research and Development Program (For primary document see N90-27275 21-61)
Avail: NTIS HC A25/MF A04 CSCL 09B

One difficulty in applying artificial intelligence techniques to the solution of real world problems is that the development and maintenance of many AI systems, such as those used in diagnostics, require large amounts of human resources. At the same time, databases frequently exist which contain information about the process(es) of interest. Recently, efforts to reduce development and maintenance costs of AI systems have focused on using machine learning techniques to extract knowledge from existing databases. Research is described in the area of knowledge extraction using a class of machine learning techniques called decision-tree classifier systems. Results of this research suggest ways of performing knowledge extraction which may be applied in numerous situations. In addition, a measurement called the concept strength metric (CSM) is described which can be used to determine how well the resulting decision tree can differentiate between the concepts it has learned. The CSM can be used to determine whether or not additional knowledge needs to be extracted from the database. An experiment involving real world data is presented to illustrate the concepts described. Author

N90-27329*# Martin Marietta Corp., New Orleans, LA. Manned Space Systems Div.
DEB: A DIAGNOSTIC EXPERIENCE BROWSER USING SIMILARITY NETWORKS **c82**
Cyprian E. Casadaban *In* NASA, Marshall Space Flight Center, Fifth Conference on Artificial Intelligence for Space Applications May 1990 p 517-524 (For primary document see N90-27275 21-61)
Avail: NTIS HC A25/MF A04 CSCL 05B

Diagnostic Experience Browser (DEB): a fusion of knowledge base and data base that allows users to examine only the data which is most useful to them is described. The system combines a data base of historical cases of diagnostic trouble-shooting

experience with similarity networks. A menu-driven natural language interface receives input about the user's current problem. Similarity networks provide the user with references to past cases that are most similar or most related to those they now face. The user can then choose the case that is most pertinent and browse its full textual description which, in turn, may include references to other related cases. Author

N90-27330*# Alabama Univ., Huntsville. Dept. of Computer Science.
ARTIFICIAL INTELLIGENCE TECHNIQUES FOR MODELING DATABASE USER BEHAVIOR **c82**
Steve Tanner and Sara J. Graves *In* NASA, Marshall Space Flight Center, Fifth Conference on Artificial Intelligence for Space Applications May 1990 p 525-534 (For primary document see N90-27275 21-61)
Avail: NTIS HC A25/MF A04 CSCL 05B

The design and development of the adaptive modeling system is described. This system models how a user accesses a relational database management system in order to improve its performance by discovering use access patterns. In the current system, these patterns are used to improve the user interface and may be used to speed data retrieval, support query optimization and support a more flexible data representation. The system models both syntactic and semantic information about the user's access and employs both procedural and rule-based logic to manipulate the model. Author

N90-27331*# Alabama A & M Univ., Normal. Dept. of Computer and Information Sciences.
RESOLUTION OF SEVEN-AXIS MANIPULATOR REDUNDANCY: A HEURISTIC ISSUE **c54**
I. Chen *In* NASA, Marshall Space Flight Center, Fifth Conference on Artificial Intelligence for Space Applications May 1990 p 535-543 (For primary document see N90-27275 21-61)
(Grant NAG8-023)
Avail: NTIS HC A25/MF A04 CSCL 05H

An approach is presented for the resolution of the redundancy of a seven-axis manipulator arm from the AI and expert systems point of view. This approach is heuristic, analytical, and globally resolves the redundancy at the position level. When compared with other approaches, this approach has several improved performance capabilities, including singularity avoidance, repeatability, stability, and simplicity. Author

N90-27332*# West Virginia Univ., Morgantown. Artificial Intelligence Lab.
THE SIXTH GENERATION ROBOT IN SPACE **c37**
A. Butcher, A. Das, Y. V. Reddy, and H. Singh *In* NASA, Marshall Space Flight Center, Fifth Conference on Artificial Intelligence for Space Applications May 1990 p 545-550 (For primary document see N90-27275 21-61)
(Contract DASG60-86-0094)
Avail: NTIS HC A25/MF A04 CSCL 13I

The knowledge based simulator developed in the artificial intelligence laboratory has become a working test bed for experimenting with intelligent reasoning architectures. With this simulator, recently, small experiments have been done with an aim to simulate robot behavior to avoid colliding paths. An automatic extension of such experiments to intelligently planning robots in space demands advanced reasoning architectures. One such architecture for general purpose problem solving is explored. The robot, seen as a knowledge base machine, goes via predesigned abstraction mechanism for problem understanding and response generation. The three phases in one such abstraction scheme are: abstraction for representation, abstraction for evaluation, and abstraction for resolution. Such abstractions require multimodality. This multimodality requires the use of intensional variables to deal with beliefs in the system. Abstraction mechanisms help in synthesizing possible propagating lattices for such beliefs. The machine controller enters into a sixth generation paradigm. Author

N90-27333*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, AL.
ROBOT DYNAMICS IN REDUCED GRAVITY ENVIRONMENT **c54**
Gary L. Workman, Tollie Grisham (Alabama Univ., Huntsville.), Elaine Hinman, and Cindy Coker *In its* Fifth Conference on Artificial Intelligence for Space Applications May 1990 p 551-556 (For primary document see N90-27275 21-61)
Avail: NTIS HC A25/MF A04 CSCL 05H

Robot dynamics and control will become an important issue for productive platforms in space. Robotic operations will be necessary for both man tended stations and for the efficient performance of routine operations in a manned platform. The current constraints on the use of robotic devices in a microgravity environment appears to be due to safety concerns and an anticipated increase in acceleration levels due to manipulator motion. The robot used for the initial studies was a UMI RTX robot, which was adapted to operate in a materials processing workcell to simulate sample changing in a microgravity environment. The robotic cell was flown several times on the KC-135 aircraft at Ellington Field. The primary objective of the initial flights was to determine operating characteristics of both the robot and the operator in the variable gravity of the KC-135 during parabolic maneuvers. It was demonstrated that the KC-135 aircraft can be used for observing dynamics of robotic manipulators. The difficulties associated with humans performing teleoperation tasks during varying G levels were also observed and can provide insight into some areas in which the use of artificial techniques would provide improved system performance. Additionally a graphic simulation of the workcell was developed on a Silicon Graphics Workstation using the IGRIP simulation language from Deneb Robotics. The simulation is intended to be used for predictive displays of the robot operating on the aircraft. It is also anticipated that this simulation can be useful for off-line programming of tasks in the future. Author

N90-27334*# Intellicorp, Mountain View, CA.
COMPILING KNOWLEDGE-BASED SYSTEMS FROM KEE TO Ada **c63**
Robert E. Filman, Conrad Bock, and Roy Feldman *In* NASA, Marshall Space Flight Center, Fifth Conference on Artificial Intelligence for Space Applications May 1990 p 557-566 (For primary document see N90-27275 21-61)
(Contract NAS8-38036)
Avail: NTIS HC A25/MF A04 CSCL 09B

The dominant technology for developing AI applications is to work in a multi-mechanism, integrated, knowledge-based system (KBS) development environment. Unfortunately, systems developed in such environments are inappropriate for delivering many applications - most importantly, they carry the baggage of the entire Lisp environment and are not written in conventional languages. One resolution of this problem would be to compile applications from complex environments to conventional languages. Here the first efforts to develop a system for compiling KBS developed in KEE to Ada (trademark). This system is called KATYDID, for KEE/Ada Translation Yields Development Into Delivery. KATYDID includes early prototypes of a run-time KEE core (object-structure) library module for Ada, and translation mechanisms for knowledge structures, rules, and Lisp code to Ada. Using these tools, part of a simple expert system was compiled (not quite automatically) to run in a purely Ada environment. This experience has given us various insights on Ada as an artificial intelligence programming language, potential solutions of some of the engineering difficulties encountered in early work, and inspiration on future system development. Author

N90-27335*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, AL.
AUTOMATED UNIT-LEVEL TESTING WITH HEURISTIC RULES
W. Homer Carlisle, Kai-Hsiung Chang, James H. Cross, William Keleher (Auburn Univ., AL.), and Keith Shackelford *In its* Fifth Conference on Artificial Intelligence for Space Applications May

1990 p 567-576 (For primary document see N90-27275 21-61)
Avail: NTIS HC A25/MF A04 CSCL 09B

Software testing plays a significant role in the development of complex software systems. Current testing methods generally require significant effort to generate meaningful test cases. The QUEST/Ada system is a prototype system designed using CLIPS to experiment with expert system based test case generation. The prototype is designed to test for condition coverage, and attempts to generate test cases to cover all feasible branches contained in an Ada program. This paper reports on heuristics sued by the system. These heuristics vary according to the amount of knowledge obtained by preprocessing and execution of the boolean conditions in the program. Author

N90-27336*# Rockwell International Corp., Seal Beach, CA. Strategic Defense Center.
SDI SATELLITE AUTONOMY USING AI AND Ada c63
Harvey E. Fiala *In* NASA, Marshall Space Flight Center, Fifth Conference on Artificial Intelligence for Space Applications May 1990 p 577-588 (For primary document see N90-27275 21-61)
Avail: NTIS HC A25/MF A04 CSCL 09B

The use of Artificial Intelligence (AI) and the programming language Ada to help a satellite recover from selected failures that could lead to mission failure are described. An unmanned satellite will have a separate AI subsystem running in parallel with the normal satellite subsystems. A satellite monitoring subsystem (SMS), under the control of a blackboard system, will continuously monitor selected satellite subsystems to become alert to any actual or potential problems. In the case of loss of communications with the earth or the home base, the satellite will go into a survival mode to reestablish communications with the earth. The use of an AI subsystem in this manner would have avoided the tragic loss of the two recent Soviet probes that were sent to investigate the planet Mars and its moons. The blackboard system works in conjunction with an SMS and a reconfiguration control subsystem (RCS). It can be shown to be an effective way for one central control subsystem to monitor and coordinate the activities and loads of many interacting subsystems that may or may not contain redundant and/or fault-tolerant elements. The blackboard system will be coded in Ada using tools such as the ABLE development system and the Ada Production system. Author

N90-27337*# Alabama Univ., Huntsville.
Ada AS AN IMPLEMENTATION LANGUAGE FOR KNOWLEDGE BASED SYSTEMS
Daniel Rochowiak *In* NASA, Marshall Space Flight Center, Fifth Conference on Artificial Intelligence for Space Applications May 1990 p 589-598 (For primary document see N90-27275 21-61)
(Contract NAS8-36955)
Avail: NTIS HC A25/MF A04 CSCL 09B

Debates about the selection of programming languages often produce cultural collisions that are not easily resolved. This is especially true in the case of Ada and knowledge based programming. The construction of programming tools provides a desirable alternative for resolving the conflict. Author

N90-27338# Aeritalia S.p.A., Turin (Italy).
PRODUCING PROCESS PLANS OUT OF CAD FILES THROUGH AI TECHNIQUES
Bruno Tranchero, Silvia Ansaldi, Luisa Boato, Francesco Morante, and Norberto Iudica (Battelle Inst., Frankfurt am Main, Germany, F.R.) 1990 9 p
(ETN-90-97273) Avail: NTIS HC A02/MF A01

The MUlti-Methods Planner (MUMP) is a tool developed for building expert process planning systems. MUMP allows the combination of variant and generative approaches to process planning and recognizes the form features on the workpiece out of its description in a Computer Aided Design (CAD) system. AI (Artificial Intelligence) techniques are involved in the interpretation of the model and in the automatic production of real life process plans. An application of the system to the case of aircraft manufacturing is presented. A general view of the system is given and the rationale behind it is explained. The experience gained in building the current experimental version is reported. ESA

N90-27339# Argonne National Lab., IL. Mathematics and Computer Sciences Div.
SOME SOFTWARE IMPLEMENTATION OF THE FUNCTIONS SINE AND COSINE
Ping Tak Peter Tang Apr. 1990 27 p
(Contract W-31-109-eng-38)
(DE90-010398; ANL-90/3) Avail: NTIS HC A03/MF A01

Several software implementations of the elementary functions sin and cos designed to fit a large class of machines are presented. Implementation details are provided. Also provided is a detailed error analysis that bounds the errors of these implementations, over the full range of input arguments, from 0.721 to 0.912 units in the last place. Tests performed on these codes give results that are consistent with the error bounds. DOE

N90-27340*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.
GENERATION OF ANIMATION SEQUENCES OF THREE DIMENSIONAL MODELS Patent Application
Sharon Poi, inventor (to NASA) and Brad N. Bell, inventor (to NASA) (Barrios Technology, Inc., Houston, TX.) 28 Jun. 1990 36 p
(NASA-Case-MSC-21379-1-SB; NAS 1.71:MSC-21379-1-SB; US-Patent-Appl-SN-545170) Avail: NTIS HC A03/MF A01 CSCL 09B

The invention is directed toward a method and apparatus for generating an animated sequence through the movement of three-dimensional graphical models. A plurality of pre-defined graphical models are stored and manipulated in response to interactive commands or by means of a pre-defined command file. The models may be combined as part of a hierarchical structure to represent physical systems without need to create a separate model which represents the combined system. System motion is simulated through the introduction of translation, rotation and scaling parameters upon a model within the system. The motion is then transmitted down through the system hierarchy of models in accordance with hierarchical definitions and joint movement limitations. The present invention also calls for a method of editing hierarchical structure in response to interactive commands or a command file such that a model may be included, deleted, copied or moved within multiple system model hierarchies. The present invention also calls for the definition of multiple viewpoints or cameras which may exist as part of a system hierarchy or as an independent camera. The simulated movement of the models and systems is graphically displayed on a monitor and a frame is recorded by means of a video controller. Multiple movement and hierarchy manipulations are then recorded as a sequence of frames which may be played back as an animation sequence on a video cassette recorder. NASA

N90-27341*# National Aeronautics and Space Administration. Pasadena Office, CA.
MODIFIED FAST FREQUENCY ACQUISITION VIA ADAPTIVE LEAST SQUARES ALGORITHM Patent Application
Rajendra Kumar, inventor (to NASA) (Jet Propulsion Lab., California Inst. of Tech., Pasadena.) 15 May 1990 25 p
(Contract NAS7-918)
(NASA-Case-NPO-17845-1-CU; NAS 1.71:NPO-17845-1-CU; US-patent-Appl-SN-523692) Avail: NTIS HC A03/MF A01 CSCL 09B

This is a method and associated apparatus for accurately and quickly estimating the amplitude, frequency and phase of a signal of interest. The method comprises the steps of, inputting the signal of interest; generating a reference signal with adjustable amplitude, frequency and phase at an output thereof; mixing the signal of interest with the reference signal and a signal 90 deg out of phase with the reference signal to provide a pair of quadrature sample signals comprising respectively a difference

between the signal of interest and the reference signal and a difference between the signal of interest and the signal 90 deg out of phase with the reference signal; using the pair of quadrature sample signals to compute estimates of the amplitude, frequency, and phase of an error signal comprising the difference between the signal of interest and the reference signal employing a least squares estimation; adjusting the amplitude, frequency, and phase of the reference signal from the numerically controlled oscillator in a manner which drives the error signal towards zero; and, outputting the estimates of the amplitude, frequency, and phase of the reference signal from the numerically controlled oscillator in a manner which drives the error signal towards zero; and, outputting the estimates of the amplitude, frequency, and phase of the error signal in combination with the reference signal to produce a best estimate of the amplitude, frequency, and phase of the signal of interest. The preferred method includes the step of providing the error signal as a real time confidence measure as to accuracy of the estimates wherein the closer the error signal is to zero, the higher the probability that the estimates are accurate. A matrix in the estimation algorithm provides an estimate of the variance of the estimation error. NASA

N90-27342# Lawrence Livermore National Lab., CA.
SISAL ON A MESSAGE PASSING ARCHITECTURE
Dale H. Grit Jan. 1990 10 p Presented at the International Conference on Parallel Processing, Zurich, Switzerland, 10-13 Sep. 1990
(Contract W-7405-eng-48)
(DE90-008786; UCRL-102791; CONF-900992-1) Avail: NTIS HC A02/MF A01

Sisal is a strongly typed, general purpose applicative language that supports data types and operations for scientific computation, and has a Pascal-like syntax to minimize learning time and enhance readability. Sisal has several important semantic properties. First, all functions are mathematically sound -- there are no side effects. Second, Sisal programs are referentially transparent. Since names are bound to valves and not memory locations, there is no aliasing. Third, the language is single-assignment -- a name is assigned a value only once. In general, a Sisal program defines a set of mathematical expressions where names stand for specific values, and computations progress without state. Sisal was developed as a cooperative effect by Lawrence Livermore National Laboratory, Colorado State University, the University of Manchester, and Digital Equipment Corporation. A primary goal of the Sisal project has been the efficient implementation of the language on commercially available computers. Implementations currently exist on several shared memory multiprocessors. This paper describes an effort to port Sisal to a message-passing, distributed memory environment. The basic characteristics of such an architecture are: a set of processing nodes, each of which contains a processing element and some local memory; and an interconnection structure which permits each node to communicate with any other node. Examples of systems which satisfy this definition are the Intel iPSC/2 and a network of SUNs. DOE

N90-27343# Argonne National Lab., IL. Mathematics and Computer Science Div.
AN ADAPTIVE BLOCKING STRATEGY FOR MATRIX FACTORIZATIONS
Christian H. Bischof and Philippe G. Lacroute 1990 12 p Presented at the CONPAR '90: International Conference on Parallel Processing, Zurich, Switzerland, 10-13 Sep. 1990
(Contract DE-W-31109-eng-38)
(DE90-011108; CONF-900992-2) Avail: NTIS HC A03/MF A01

On most high-performance architectures, data movement is slow compared to floating-point (in particular, vector) performance. On these architectures block algorithms have been successful for matrix computations. By considering a matrix as a collection of submatrices (the so-called blocks) one naturally arrives at algorithms that require little data movement. The optimal blocking strategy, however, depends on the computing environment and on the problem parameters. Current approaches use fixed-width blocking strategies which are not optimal. This paper presents an adaptive blocking methodology for determining in a systematic manner an optimal blocking strategy for a uniprocessor machine. We demonstrate this technique on a block QR factorization routine on a uniprocessor. After generating timing models for the high-level kernels of the algorithm we can formulate the optimal blocking strategy in a recurrence relation that we can solve inexpensively with a dynamic programming technique. Experiments on one processor of a CRAY 2 show that in fact the resulting blocking strategy is as good as any fixed-width blocking strategy. So while we do not know the optimum fixed-width blocking strategy unless we re-run the same problem several times, adaptive blocking provides optimum performance in the very first run. DOE

N90-27344# Argonne National Lab., IL. Computing and Telecommunications Div.
A PLAN FOR SCIENTIFIC VISUALIZATION AT ANL
Torri A. Bennington, ed. and John Rowlan Mar. 1990 27 p
(Contract W-31-109-eng-38)
(DE90-013565; ANL/TM-476) Avail: NTIS HC A03/MF A01

This report discusses the uses of scientific visualization through computer simulation and graphics. Also covered are hardware and software tools available to users. DOE

N90-27345# Sandia National Labs., Albuquerque, NM. Aeroballistics Div.
A USER'S MANUAL FOR MCPRAM (MONTE CARLO PREPROCESSOR FOR AMEER) AND FOR THE FUZE OPTIONS IN AMEER (AERO MECHANICAL EQUATION EVALUATION ROUTINES)
R. A. LaFarge May 1990 45 p
(Contract DE-AC04-76DP-00789)
(DE90-013598; SAND-90-0483) Avail: NTIS HC A03/MF A01

MCPRAM (Monte Carlo PReprocessor for AMEER), a computer program that uses Monte Carlo techniques to create an input file for the AMEER (aeromechanical equation evaluation routines) trajectory code, has been developed for the Sandia National Laboratories VAX and Cray computers. Users can select the number of trajectories to compute, which AMEER variables to investigate, and the type of probability distribution for each variable. Any legal AMEER input variable can be investigated anywhere in the input run stream with either a normal, uniform, or Rayleigh distribution. Users also have the option to use covariance matrices for the investigation of certain correlated variables such as booster pre-reentry errors and wind, axial force, and atmospheric models. In conjunction with MCPRAM, AMEER was modified to include the variables introduced by the covariance matrices and to include provisions for six types of fuze models. The new fuze models and the new AMEER variables are described. DOE

N90-27346# Computational Logic, Inc., Austin, TX.
GENERALIZATION IN THE PRESENCE OF FREE VARIABLES: A MECHANICALLY-CHECKED CORRECTNESS PROOF FOR ONE ALGORITHM
Matt Kaufmann Apr. 1990 95 p
(Contract N00014-88-C-0454)
(AD-A222681; TR-53) Avail: NTIS HC A05/MF A01 CSCL 12/7

A mechanically-checked proof of correctness is presented for a generalization algorithm. Although the theorem itself is probably new (at least, there is no awareness of any existing statement of it), the interest here lies not particularly in the theorem per se but, rather, lies in the demonstration of the use of mechanical verification for assisting the reliability of detailed proofs and software. In particular, it is believed that this exercise strongly suggests the feasibility of creating a verified version of PC-NQTHM, i.e., one which is proved correct in the Boyer-Moore theorem prover or in some successor of that system. Thus, this paper could be viewed as a contribution to the study of metatheoretically extensible systems. Some reports of research in this spirit can be found in works of Davis and Schwartz (6), Weyhrauch (18), Boyer and Moore (2), Shankar (16), Knoblock and Constable (14, 13), Howe (9), and Quaife (15). However, this paper could also be viewed as

an exposition which provides a rather detailed look at the practice of using the Boyer-Moore theorem prover and PC-NQTHM to proof-check mathematical arguments. GRA

N90-27347# Massachusetts Inst. of Tech., Cambridge. Lab. for Computer Science.
NON-INTERACTIVE ZERO KNOWLEDGE
Manuel Blum, Alfredo DeSantis, Silvio Micali, and Giuseppe Persiano (Harvard Univ., Cambridge, MA.) 27 May 1990 38 p
(Contract N00039-88-C-0163; NSF DCR-85-13926; NSF CCR-87-19689)
(AD-A222698; MIT/LCS/TM-430) Avail: NTIS HC A03/MF A01 CSCL 12/2

The possibility of disposing of interaction between Prover and Verifier is investigated in a zero-knowledge proof if they share beforehand a short random string. Without any assumption, it is proved that non-interactive zero-knowledge proofs exist for some number theoretic languages for which no efficient algorithm is known. If deciding quadratic residuosity (modulo composite integers whose factorization is not known) is computationally hard, we show that the NP-complete language of satisfiability also possesses noninteractive zero-knowledge proofs. GRA

N90-27348*# Illinois Univ., Urbana. Coordinated Science Lab.
EFFICIENT INSTRUCTION SEQUENCING WITH INLINE TARGET INSERTION
Wen-mei W. Hwu and Pohua P. Chang May 1990 51 p
Sponsored in part by NCR, Liberty, SC
(Contract NAG1-613; N00014-88-K-0656; NSF MIP-88-09478)
(NASA-CR-185341; NAS 1.26:185341; AD-A222807; UILU-ENG-90-2215; CSG-123) Avail: NTIS HC A04/MF A01 CSCL 09/2

The trend of deep pipelining and multiple instruction issue has made instruction sequencing an extremely critical issue. Traditionally, compiler-assisted instruction sequencing methods have been considered not suitable for deep pipelining and multiple instruction issue. Hardware methods such as Branch Target Buffers have been proposed for deep pipelining and multiple instruction issue. This paper defines Inline Target Insertion, a specific compiler and pipeline implementation method for Delayed Branches with Squashing. The compiler part of Inline Target Insertion has been shown to be straightforward with an implementation in the IMPACT-I C Compiler. A new code expansion control method has been proposed and included in the implementation. The code expansion and instruction sequencing efficiency are measured for real UNIX and CAD programs. The size of programs, the variety of programs, and the variety of inputs to each program are significantly larger than those used in the previous experiments. The stability of code restructuring based on profile information is proved empirically using a large number of diverse inputs to each benchmark program. The results show that Inline Target Insertion achieves high sequencing efficiency at a small cost of code expansion for deep pipelining and multiple instruction issue. GRA

N90-27349# Minnesota Univ., Minneapolis.
ROBUSTNESS, DIAGNOSTICS, COMPUTING, AND GRAPHICS IN STATISTICS Final Report, 1 Apr. 1989 - 31 Mar. 1990
Willard Miller, Jr. 1990 24 p
(Contract DAAL03-89-G-0026)
(AD-A222888; ARO-26717.1-MA-CF) Avail: NTIS HC A03/MF A01 CSCL 12/8

The workshop on robustness, diagnostics, computing and graphics in statistics was held on July 21, 1989 to August 12, 1989. Robustness, Diagnostics volumes 1 and 2 will appear in IMA Volumes in Mathematics and its Applications, Springer-Verlag, New York. Computing and Graphics in Statistics will appear in IMA volumes in Mathematics and its Applications, Springer-Verlag, New York. GRA

N90-27350# Brunel Univ., Uxbridge (England).
COMPUTER ASSISTED ANALYSIS AND MODELLING OF STRUCTURED PROBLEMS Interim Report No. 6, Dec. 1988 - Mar. 1990
E. Hadjiconstantinou (Imperial Coll. of Science and Technology, London, England) and G. Mitra 29 May 1990 17 p
(Contract DAJA45-87-C-0003; DA Proj. 1L1-61102-BH-57)
(AD-A222991; TR/1/90; R/D-5338-CC-03) Avail: NTIS HC A03/MF A01 CSCL 12/4

Our research efforts are focused on developing a systematic procedure for transforming a set of logical conditions imposed on a mathematical optimization model into an integer linear programming formulation. Through reformulation of logical forms into integer forms we support a uniform and powerful representation of a problem, consisting of a tightly interrelated closed system of choices. We describe a systematic approach for transforming statements in Boolean Algebra into integer or mixed integer linear programs. The method is particularly suitable as a modelling technique that allows logical relationships connecting variables and linear constraints to be modelled as integer and mixed integer programs. We are preparing and illustrating a few example (logic) problems processed by this method which are set out to explain reformulation and modelling techniques. GRA

N90-27351# Air Force Inst. of Tech., Wright-Patterson AFB, OH. School of Engineering.
EXPERT SYSTEM IN SOFTWARE ENGINEERING USING STRUCTURED ANALYSIS AND DESIGN TECHNIQUE (SADT) M.S. Thesis
Intaek Kim Jun. 1990 236 p
(AD-A223022; AFIT/GCS/ENG/90J-02) Avail: NTIS HC A11/MF A02 CSCL 12/5

The design and implementation of the Knowledge Based Software Assistant System (KBSAS) for the Structured Analysis Design Technique (SADT) method developed by Softech, Inc. is examined. A Graphics Editor is used to create specific Structured Analysis (SA) diagrams and a graphical symbol syntax is derived from these diagrams. The development of the KBSAS is divided into two parts: the design and implementation of a graphics translator and an application of a knowledge based system for syntax checking. First, the objective of the translator is to map a subset of the graphical symbol syntax from a SA diagram into the first order predicate calculus. The SA diagram information is represented in a set of predicate data forms. Secondly, the objective of a knowledge based system is to evaluate adherence to proper SADT syntax. This is accomplished by generating SA rules associated with either an activity box or boundary arrows. The requirements analyst and the designer are provided with a means of recovering from a graphical symbol syntax error(s) through a display window. Specific emphasis focuses on a comprehensive mapping of the graphical symbol syntax to predicate logic as well as development of an application of a rule-based system using this capability. GRA

N90-27352# Naval Postgraduate School, Monterey, CA.
THE IDENTIFICATION OF SOFTWARE FAILURE REGIONS M.S. Thesis
John Manning Bolchoz Jun. 1990 99 p
(AD-A223058) Avail: NTIS HC A05/MF A01 CSCL 12/5

In these days of spiralling software costs and the proliferation of computers, software testing during development is now recognized as a critical aspect of the software engineering process, an aspect that must be improved in terms of cost and timeliness. One method is described that may guide software testing by analyzing the regions of input associated with each fault as it is detected. These software failure regions are defined and a method of failure region analysis is described in detail. How this analysis may be used to detect non-obviously redundant test cases is described. A preliminary examination of the manual analysis method is performed with a set of programs from a prior reliability experiment. Based on faults discovered during the previous experiment, definitions are given of the reachability conditions, the error generation conditions, and the conditions in which an error is not masked by later processing The manual analysis of failure regions can be a difficult process, with difficulty dependent on program size, program complexity, and the size of the input data space. Program constructs and events that simplify the

analysis process are also described. Variable communication and the effects of vertical and horizontal contamination is explained. The indirect benefits of performing failure region analysis is also described. Finally, there are several open questions raised by this research, and these questions are presented as ideas for future research. GRA

N90-27353# Northwestern Univ., Evanston, IL. Dept. of Electrical Engineering.
KNOWLEDGE BASED QUALITY ASSURANCE TOOLS Final Report, Nov. 1988 - Nov. 1989
Stephan S. Yau, Gwo-Long Huang, Jinshuan Lee, and Yeou-Wei Wang Mar. 1990 97 p
(Contract F30602-81-C-0185; AF Proj. 5581)
(AD-A223064; RADC-TR-90-14) Avail: NTIS HC A05/MF A01 CSCL 12/5

A long range approach for integrating software quality information with knowledge based engineering technology was developed. A Software Quality Assurance Expert System framework was proposed to plan software quality assurance activities, evaluate systems designs, balance mutually conflicting quality factors, and make design refinement suggestions. This effort determined the basic system architecture and interaction among system components. The proposed expert system framework would include data objects of an Object-Oriented Data Base, a Rule Set, Meta Rules, and a Dependency-Based Truth Maintenance System. To help illustrate how such a system could be used, examples were provided to show how the expert system could assist Software Quality Assurance activities for software reliability. The DOD community will benefit from the results of this work; particularly, anyone attempting to use expert systems to improve the quality of their software. GRA

N90-27354# Defence Research Establishment Atlantic, Dartmouth (Nova Scotia).
POST SCRIPT CODE FOR GREY-SCALED DISPLAYS
G. J. Heard Apr. 1990 31 p
(AD-A223099; DREA-TC-90/304) Avail: NTIS HC A03/MF A01 CSCL 12/5

Post Script is a versatile page description language used for the production of complex images combining graphics and text information. This note describes a Post Script program capable of producing a detailed grey-scaled image of information represented by a series of hexadecimal codes. A parameter section is included in the Post Script code that allows the user to modify the appearance of the diagram without the need to re-execute the program that generated the data and/or Post Script file in the first place. This code can be used on many different systems that support a Post Script printing device, but was originally intended for a 300 dot per inch laser printer. The Post Script code contains procedures to create time strings in hours, minutes, and seconds format from an input value in decimal hours. GRA

N90-27355# Defence Research Establishment, Ottawa (Ontario). Chemical Protection Section.
AN ALGORITHM FOR AUTOMATED SURFACE MODELLING IN UNIGRAPHICS
D. Hidson Mar. 1990 30 p
(AD-A223219; DREO-TN-90-6) Avail: NTIS HC A03/MF A01 CSCL 12/5

This paper describes programs written in Graphics Interactive Programming Language (GRIP) to generate models in the Unigraphics CAD/CAM database of complex three-dimensional geometry relating to human body shape. Data from human faceform models gathered by remote laser sensing was transferred to the CAD/CAM system. The large data files (30,000 points) were edited down to more manageable sizes of approximately 3,000 points. Programs were written in GRIP: (1) to sort points into regular arrays, (2) to generate complete sets of orthogonal spline curves spanning the sets of points, (3) to create sets of sculptured surface patches covering the data and (4) to display and store the resulting information. The final surface renderings are shown as displays on a vector refresh terminal. GRIP source code is included. The software allows for the generation of sculptured surfaces from any regular, point data set. GRA

N90-27356# Massachusetts Inst. of Tech., Cambridge. Lab. for Computer Science.
DISCONNECTED ACTIONS: AN ASYNCHRONOUS EXTENSION TO A NESTED ATOMIC ACTION SYSTEM M.S. Thesis
Boaz Ben-Zvi Jan. 1990 111 p
(Contract N00014-83-K-0125; NSF DCR-85-03662)
(AD-A221937; MIT/LCS/TR-475) Avail: NTIS HC A06/MF A01 CSCL 12/7

Nested transactions, a generalization of atomic transactions, provide a uniform mechanism for coping with failures and obtaining concurrency within an action. Execution of a nested action is synchronized with its creating action by halting the creator until the execution of its nested action terminates. A new kind of a nested action is proposed called a Disconnected Action (DA) that runs asynchronously with its creating action. Disconnected actions allow additional work to be done in parallel with the rest of the work in a nested atomic action system. Work done by a DA improves the performance of its creating action, but is not needed for the correctness of this action. The achievement of DA semantics is described; existing mechanisms, such as the two-phase commit, are modified, and serial behavior of DAs is ensured by a mechanism that uses timestamps to enforce static creation order, and tables to monitor and control dynamic serialization order of concurrent DAs. A technique is also presented that allows an action using DAs to commit in spite of some failures. GRA

N90-27357# Yale Univ., New Haven, CT. Dept. of Computer Science.
SOME REMARKS ON THE GENERALISED BAREISS AND LEVINSON ALGORITHMS
Ilse C. F. Ipsen Feb. 1990 18 p
(Contract N00014-88-K-0573)
(AD-A221957; YALEU/DCS/RR-762) Avail: NTIS HC A03/MF A01 CSCL 12/1

The Bareiss (or Schur) and Levinson algorithms are the most popular algorithms for solving linear systems with dense n x n Toeplitz coefficient matrix in O(n squared) arithmetic operations. Both algorithms were generalised to solve linear systems whose n x n coefficient matrices A are not necessarily Toeplitz (in O(n cubed) operations). It is shown that the generalized Levinson algorithm is a direct consequence of the generalized Bareiss algorithm, thereby considerably simplifying its presentation in comparison to previous work. GRA

N90-27358# Society for Industrial and Applied Mathematics, Philadelphia, PA.
THE SECOND ASILOMAR WORKSHOP ON PROGRESS IN MATHEMATICAL PROGRAMMING Final Report, 1 Dec. 1988 - 30 Nov. 1990
Margaret H. Wright (Bell Telephone Labs., Inc., Murray Hill, NJ.) Feb. 1990 16 p Workshop held in Asilomar, CA, 5-7 Feb. 1990
(Grant AF-AFOSR-0023-90; AF Proj. 2304)
(AD-A221986; AFOSR-90-0561TR) Avail: NTIS HC A03/MF A01 CSCL 12/4

On the theory side, new complexity results were presented for various interior linear programming methods. New interior methods with polynomial complexity were described for certain quadratic programming, convex nonlinear programming, integer programming and linear complementarity problems. Strategies have also been developed for retaining polynomial convergence starting from an infeasible point. For all problem categories, properties of Newton's method and of the central path (the trajectory of minimizers of the logarithmic barrier function) play a key role in much of the analysis. A frequent theme is the development of large-step methods that do not require the iterates to follow the central path closely, yet achieve a polynomial complexity bound. Research on the anticipated complexity of certain interior methods may help to

explain why the performance of these methods is substantially superior to their worst-case bounds. GRA

N90-27359# Rice Univ., Houston, TX. Dept. of Computer Science.
A THEORETICAL MODEL OF OPTIMISTIC RECOVERY IN DISTRIBUTED SYSTEMS Final Technical Report
Willy Zwaenepoel 8 May 1990 7 p
(Contract N00014-88-K-0140)
(AD-A222055) Avail: NTIS HC A02/MF A01 CSCL 12/5

The research sponsored by this contract has produced the following results: (1) A model for recovery using message logging and checkpointing, resulting in a major theorem establishing the uniqueness of a maximum recoverable system state; (2) An implementation and a performance evaluation of sender-based message logging; (3) A batch and an incremental algorithm for optimistic recovery, and an implementation and a performance evaluation of optimistic recovery; (4) Preliminary results in extending these methods to nondeterministic processes; and (5) A new definition of distributed breakpoint, called causal distributed breakpoint. GRA

N90-27360# Royal Signals and Radar Establishment, Malvern (England).
ZADOK USER GUIDE
G. P. Randell Jan. 1990 39 p
(AD-A222071; RSRE-Memo-4356; DRIC-BR-113367) Avail: NTIS HC A03/MF A01 CSCL 12/7

A guide is provided for users of Zadok, the Z syntax and typechecker developed by the SCEIP Unit at RSRE. It is assumed that users of this tool may not be familiar with the Perq computer operating with the Flex system, so an introduction to the use of Flex is given. Some knowledge of Z is assumed. This Guide also introduces the keyware software developed by the SMITE team at RSRE which is used with the Z tool. Other topics covered are how to use the Z editor; how to run the Z typechecker and correct errors it may find in your file of Z; and how to print your file using a PostScript printer. Two issues relating to the Z language are discussed, namely differences between the syntax used by the typechecker and that given in Spivey's reference manual (Spivey88), and the style of language adopted by the typechecker. Some known problems with the Z tools are described, including the editor, and advice is given on how to deal with these. The annexes contain the Z symbols used by the editor, and what they mean, the Z library of basic mathematical constructs used by the typechecker and the Z syntax used by the tool. GRA

N90-27361# Rice Univ., Houston, TX. Dept. of Computer Science.
RECOVERY IN DISTRIBUTED SYSTEMS USING OPTIMISTIC MESSAGE LOGGING AND CHECKPOINTING
David B. Johnson and Willy Zwaenepoel Sep. 1990 28 p Submitted for publication
(Contract N00014-88-K-0140; NSF CCR-87-16914; NSF CDA-86-19893)
(AD-A222104) Avail: NTIS HC A03/MF A01 CSCL 12/5

Message logging and checkpointing can provide fault tolerance in distributed systems in which all process communication is through messages. A general model is presented for reasoning about recovery in these systems. Using this model, it is proved that the set of recoverable system states that have occurred during any single execution of the system forms a lattice, and that therefore, there is always a unique maximum recoverable system state, which never decreases. Based on this model, we present an algorithm for determining this maximum recoverable state, and prove its correctness. The algorithm utilizes all logged messages and checkpointing have not considered the existing checkpoints, and thus may not find this maximum state. Furthermore, by utilizing the checkpoints, some messages received by a process before it was checkpointed may not need to be logged. Using the algorithm also adds less communication overhead to the system than do previous methods. The model and algorithm can be used with any message logging protocol, whether pessimistic or optimistic, but their full generality is only required with optimistic logging protocols. GRA

N90-27362# Princeton Univ., NJ. Dept. of Computer Science.
MAINTENANCE OF A MINIMUM SPANNING FOREST IN A DYNAMIC PLANAR GRAPH
David Eppstein, Giuseppe F. Italiano, Roberto Tamassia, Robert E. Tarjan, Jeffery Westbrook, and Moti Yung (International Business Machines Corp., Yorktown Heights, NY.) Jan. 1990 31 p Presented at the 1st ACM-SIAM Symposium on Discrete Algorithms, San Francisco, CA, Jan. 1990 Submitted for publication Sponsored in part by IBM
(Contract N00014-87-K-0467; NSF CCR-88-14977; NSF DCR-86-05962; NSF STC-88-09648)
(AD-A221425; CS-TR-243-90) Avail: NTIS HC A03/MF A01 CSCL 12/4

Efficient algorithms are given for maintaining a minimum spanning forest of a planar graph subject to on-line modifications. The modifications supported include changes in the edge weights, and insertion and deletion of edges and vertices. To implement the algorithms, a data structure called an edge-ordered dynamic tree, which is a variant of the dynamic tree data structure of Sleator and Tarjan was developed. Using this data structure, the algorithms run in O(log n) time per operation and O(n) space. The algorithms can be used to maintain the connected components of a dynamic planar graph in O(log n) time per operation. GRA

N90-27363# IIT Research Inst., Rome, NY.
DATA AND ANALYSIS CENTER FOR SOFTWARE Final Technical Report, Apr. 1986 - Jun. 1989
Nancy L. Sunderhaft and Stephen T. Kelly Mar. 1990 76 p
(Contract F30602-86-C-0111)
(AD-A221434; RADC-TR-90-9) Avail: NTIS HC A05/MF A01 CSCL 12/5

The Data and Analysis Center for Software discusses its operation and enhancement. Descriptions of the Software Life Cycle Empirical Database and the scientific and technical information data base are provided by DACS, products developed during the period and the technical inquires received relating to Software Technology. Special studies performed for DACS users on software technology problems and issues are also described. GRA

N90-27364# Rutgers - The State Univ., New Brunswick, NJ. Lab. for Computer Science Research.
ARCHITECTURES FOR OPTICAL COMPUTING Final Report, 1 Sep. 1986 - 31 Jan. 1990
Saul Levy 31 Jan. 1990 108 p
(Grant AF-AFOSR-0294-86; AF Proj. 2305)
(AD-A221435; AFOSR-90-0425TR) Avail: NTIS HC A06/MF A01 CSCL 12/6

The activities of the CAM group are recorded herein. These consist of the development of several experimental software systems on an AMT DAP (Distributed Array Processor) for evaluation and research purposes. The resulting determinations of the strengths and weakness of the DAP are discussed. Two new machine architectures were developed in an attempt to consolidate the strengths and overcome the weaknesses. The effort led to the analysis of certain parallel algorithms from a new point of view, and thus to a new class of parallel algorithms, the semi-serial algorithms. GRA

N90-27365# Harry Diamond Labs., Adelphi, MD.
PERSONAL COMPUTER PROGRAMS FOR THE CONTROL OF SUBNANOSECOND TRANSIENT DIGITIZERS WITH APPLICATIONS FOR DEVICE DAMAGE TESTING Final Report, Jan. - Oct. 1987
James J. Loftus Mar. 1990 137 p
(AD-A221458; HDL-TM-90-2; DOD/SW/DK-90-009A) Avail: NTIS HC A07/MF A01 CSCL 12/5

Electronic or electromagnetic events with subnanosecond rise times can be recorded by two transient digitizers controlled by a

personal computer through the General Purpose Interface Bus (GPIB). The subnanosecond capability is dependent on the digitizer configuration, specifically the vertical amplifier plug-in for the digitizer. The programs described in this manual, which were written as part of the Harry Diamond Laboratories EMP (Hardening) Technology Program, make direct provisions for device damage testing. While this testing requires slower rise-time plug-ins, the programs can be used for digitizers in the faster rise-time configuration. These programs are easily modified for other applications. In addition to controlling and operating the digitizers, the programs provide for the presentation, storage, retrieval, and recordkeeping of the data files. The digitizers are not applicable to when data records longer than 10 ms are required. GRA

N90-27366# California Univ., Los Angeles. Dept. of Mathematics.
ALGORITHMS TO SOLVE NONLINEAR TIME DEPENDENT PROBLEMS OF ENGINEERING AND PHYSICS Final Report, 1 Aug. 1986 - 31 May 1989
Stanley Osher 30 Jun. 1989 5 p
(Contract F49620-86-C-0115; AF Proj. 5783)
(AD-A221463; AFOSR-89-1200TR) Avail: NTIS HC A01/MF A01 CSCL 12/1

During this last year Osher developed a joint project with James Sethian concerning fronts propagating with curvature dependent speed. They devised new algorithms approximating the equations of motion, which resemble Hamilton-Jacobi equations with parabolic right-hand sides, by using techniques from hyperbolic conservation laws. Essentially non-oscillatory schemes are used. These methods accurately capture the formation of sharp gradients and cusps in the moving fronts. The algorithms handle topological merging and breaking naturally, and work in any number of space dimensions. The methods can also be used for more general Hamilton-Jacobi type problems. Applications of the algorithms include crystal growth, solidification of metals and flame propagation. GRA

N90-27367# Maryland Univ., College Park. Inst. for Advanced Computer Studies.
KNOWLEDGE REPRESENTATION IN PARKA
Lee Spector, James A. Hendler, and Matthew P. Evett Feb. 1990 30 p
(Contract N00014-88-K-0560; NSF IRI-89-07890)
(AD-A221471; UMIACS-TR-90-23; CS-TR-2410) Avail: NTIS HC A03/MF A01 CSCL 12/5

This paper describes a frame-based knowledge representation system called PARKA which runs on the Connection Machine. The PARKA language was designed to take advantage of the Connection Machine architecture in order to provide extremely fast query processing capabilities. While the primary goal in PARKA's design was to explore the use of massive parallelism in symbolic knowledge representation, we have also tried to respond to many of the criticisms and to take advantage of many of the advances documented in the literature of frame languages. PARKA provides a principled approach to multiple inheritance based on the work of Touretzky, and a new mechanism for the representation of part/whole relations. In addition, we have made efforts to make the intended meanings of PARKA representations clear from the perspective work in the philosophy of language. The result is a practical representation system that can run very quickly on parallel hardware. A specification of the syntax of the PARKA language is provided as an appendix. GRA

N90-27368# Rochester Univ., NY. Dept. of Computer Science.
A PROGRAMMING ENVIRONMENT FOR PARALLEL VISION ALGORITHMS Final Technical Report, Feb. 1988 - Dec. 1989
Christopher Brown 11 Apr. 1990 78 p Sponsored in part by DARPA, Arlington, VA
(Contract DACA76-85-C-0001)
(AD-A221486; ETL-0563) Avail: NTIS HC A05/MF A01 CSCL 23/3

This contract developed and disseminated papers, ideas, algorithms, analysis, software, applications, and implementations for parallel programming environments for computer vision and for vision applications. The work has been widely reported and highly influential. The most significant work centered on the Butterfly Parallel Processor, the MaxVideo pipelined parallel image processor, and the development of the real-time computer vision laboratory. For the Butterfly, the Psyche multi-model operating system was developed and the CONSUL autoparallelizing compiler was designed. Much basic and influential performance monitoring and debugging work was completed, resulting in working systems and novel algorithms. There was also significant research in systems and applications using other parallel architectures in the laboratory, such as the MaxVideo parallel pipelined image processor. The contract developed a heterogeneous parallel architecture involving pipelined and Multiple Instruction/Multiple Data (MIMD) parallelism and integrated it with a robot head. GRA

N90-27369# Florida Univ., Alachua. Inst. for Astrophysics and Planetary Exploration.
ROBFIT: A CODE FOR THE ANALYSIS OF HISTOGRAM SPECTRA WITH NONLINEAR REGRESSION AND ROBUST ESTIMATION Final Report, 1 Jun. 1987 - 31 Aug. 1990
R. L. Coldwell and G. J. Bamford 4 May 1990 297 p
(Contract N00014-87-J-1259)
(AD-A221527) Avail: NTIS HC A13/MF A02 CSCL 12/5

This book contains the information needed to use the spectral fitting code ROBFIT. It explains the physical and mathematical foundations of the algorithms used in the code and describes how to apply the code to real spectra. ROBFIT is a computer automated spectrum analysis package which tries to extract the maximum information from a histogram of intensity versus channel number. A non-linear minimization routine which uses a generalization of the Newton-Raphson technique has been developed and tested at the University of Florida's Department of Physics and Institute for Astrophysics and Planetary Exploration. This algorithm, simultaneous equation solver (SMSQ), is the central core of ROBFIT; SMSQ ensures the code finds the minimal fit, even with large numbers of non-linear constants in the fit. The intended user code is the person needing quick and accurate peak fitting with little user intervention. We have endeavored to make the code as user tolerant as possible and to the end we have included a user's guide in the book. GRA

N90-27370# Naval Surface Warfare Center, Dahlgren, VA. Dept. of Engineering and Information Systems.
STATLIB: NSWC LIBRARY OF STATISTICAL PROGRAMS AND SUBROUTINES Final Report
Marlin A. Thomas, Gary W. Gemmill, and John R. Crigler Aug. 1989 289 p
(AD-A221538; NSWC-TR-89-97) Avail: NTIS HC A13/MF A02 CSCL 12/5

STATLIB is a direct access file on the CDC General Purpose Computers at NSWC under UN=LIBRARY. It contains over 50 programs and subroutines for statistical data analysis and random number generation. The programs are initiated interactively via a menu driver (STATMNU) which queries the user for the name of the program he desires to run. User name, charge code, input file and printing instructions are requested and then a batch job is submitted for him accordingly. The results are returned to the user's directory in a file named STATOUT (or a user specified filename) which is created for him. The subroutines are initiated within the user's main program. Their call lines and arguments are described, but since they are not menu driven, they do not appear in the menu of programs. GRA

N90-27371# Hulburt (E. O.) Center for Space Research, Washington, DC. Ionospheric Effects Branch.
EINMUF: AN HF MUF, FOT, LUF PREDICTION PROGRAM Final Report, Mar. - Dec. 1989
Mark Daehler 18 May 1990 51 p
(Contract MIPR-89-CS-8084)
(AD-A221577; NRL-MR-6645) Avail: NTIS HC A04/MF A01 CSCL 12/5

This work describes a FORTRAN algorithm, called Subroutine

EINMUF, which predicts the Maximum Usable Frequency (MUF), the Frequency of Optimum Transmission (FOT), and the Lowest Usable Frequency (LUF) on a specified HF communications path. A single call to EINMUF produces up to 24 predictions at hourly intervals starting with a specified day-time group DTG. MOF calculations are made with the NOSC MINIMUF85 MUF-prediction program using the first available sunspot number SSN from the following list: (1) an effective SSN derived from current oblique-incidence sounder data; (2) a 5-day running average of SSNs derived from solar 10.7 cm flux measurements or direct SSN measurements; (3) an effective SSN determined from old sounder data; (4) SSN extrapolated from previous SSN measurements by the McNish-Lincoln method; (5) SSN derived from a mean-value representation of the 11-year solar sunspot number cycle. GRA

N90-27372# Naval Postgraduate School, Monterey, CA.
DIGITAL SIGNAL PROCESSING SOFTWARE PACKAGES FOR IBM-PC AND IBM-PC WITH DSP-16 M.S. Thesis
Gregory James Pitman Dec. 1989 59 p
(AD-A221679) Avail: NTIS HC A04/MF A01 CSCL 12/5

This thesis provides two versions of a digital signal processing (DSP) program that can be used by an individual interactively. The intended user for this program is a student taking a digital speed signal processing class at the Naval Postgraduate School. Nevertheless, the implemented algorithms can be used to analyze any slowly time-varying signals. One version uses a MS-DOS computer (or IBM-compatible) for both data handling and for the DSP algorithms. The other version uses the MS-DOS computer for data handling and uses an Ariel DPS-16 digital signal processing board for the DSP algorithms. All algorithms are implemented in a non real-time mode. The program uses the same user-interface software for both versions. The user-interface software package provides a user-friendly input and output environment. GRA

N90-27373# Rochester Univ., NY. Dept. of Computer Science.
ARMTRAK: A DOMAIN FOR THE UNIFIED STUDY OF NATURAL LANGUAGE, PLANNING, AND ACTIVE VISION
N. G. Martin, J. F. Allen, and C. M. Brown Jan. 1990 46 p
(Contracts N00014-82-K-0193; N00014-80-C-0197; F30602-85-C-0008; AF-AFOSR-0222-89)
(AD-A221701; TR-324) Avail: NTIS HC A03/MF A01 CSCL 05/7

ARMTRAK is a micro-world, based on the control of model trains, designed to integrate work in natural language, planning, vision and robotics. The primary advantage of the domain is it provides examples that involve only few objects but that require sophisticated analysis. Because the examples involve few objects, the complex reasoning required is not intractable. On the other hand, more objects can be introduced to study techniques for tractable reasoning. Simple and complex examples in the same domain allow work at different levels to take place simultaneously. As a planning domain, ARMTRAK allows exercising planners in a real time domain about which the planner has only imperfect knowledge. As a domain for natural language research, it allows research into the grounding of language in real situations, and the problem of coordinating the behavior of agents through language. As a domain for active vision research, it is challenging because it requires extracting information whose parameters cannot be completely specified beforehand. Two implementations of ARMTRAK were developed: a simulation and a version using the Rochester Robot. The simulation allows work on real time planning, and a robot version shows the feasibility of a real working system based on model trains. GRA

N90-27374# Naval Ocean Systems Center, San Diego, CA.
LINEAR ALGEBRA ON A CRAY X-MP
R. F. Freund Apr. 1990 13 p
(AD-A221780; NOSC/TD-1670) Avail: NTIS HC A03/MF A01 CSCL 12/5

Basic issues are discussed of vectorization as well as memory organization and contention for vector machines. There is an analysis of the implications of these issues for the performance of basic linear algebra operations, SAXPY and SDOT. GRA

N90-27375# Stanford Univ., CA. Dept. of Operations Research.
A BUILD-UP INTERIOR METHOD FOR LINEAR PROGRAMMING: AFFINE SCALING FORM
George B. Dantzig and Yinyu Ye (Iowa Univ., Iowa City.) Feb. 1990 30 p
(Contracts N00014-89-J-1659; DE-FG03-87ER-25028; NSF DDM-88-14253; NSF DMS-89-13080)
(AD-A221802; SU-SOL-90-4) Avail: NTIS HC A03/MF A01 CSCL 12/4

A build-up interior method is proposed for solving an m equation n variable linear program which has the same convergence properties as their well known analogues in dual affine and projective forms but requires less computational effort. The algorithm has three forms, an affine scaling form, a projective scaling form, and an exact form (that used pivot steps). The first of these is presented. It differs from Dikin's algorithm of dual affine form in that the ellipsoid chosen to generate the improving directions in dual space is constructed from only a subset of the dual constraints. GRA

N90-27376# Defence Research Establishment, Ottawa (Ontario). Chemical Protection Section.
MODIFICATION OF A CAM FACILITY
D. Hidson Mar. 1990 18 p
(AD-A221828; DREO-TN-90-7) Avail: NTIS HC A03/MF A01 CSCL 12/6

A CAD/CAM system is described in which a Data General MV4000 computer serves as a hardware platform for Unigraphics software. A paper tape punch facility is replaced by a floppy disk file storage system. Commands for storing, editing and reading files on the floppy disk are described, and the file structure required for a Matsuura CNC machine and Fanuc controller are included. The device also replaces the tape reader on the CNC machine by means of a parallel port. GRA

N90-27377# Yale Univ., New Haven, CT. Dept. of Computer Science.
IMPROVING THE ACCURACY OF INVERSE ITERATION
Elizabeth R. Jessup and Ilse C. F. Ipsen Mar. 1990 46 p
(Contract N00014-88-K-0573)
(AD-A221846; YALEU/DCS/RR-767) Avail: NTIS HC A03/MF A01 CSCL 12/5

The EISPACK routine TINVIT is an implementation of inverse iteration for computing eigenvectors of real symmetric tridiagonal matrices. Experiments have shown that the eigenvectors computed with TINVIT are numerically less accurate than those from implementations of Cuppen's divide and conquer method (TREEQL) and of the QL method (TQL2). The loss of accuracy can be attributed to TINVIT's choice of starting vectors and to its iteration stopping criterion. A new implementation of TINVIT is introduced that computes each eigenvector from a different random starting vector and performs an additional iteration after the stopping criterion is satisfied. A statistical analysis and the results of numerical experiments are presented with matrices of order up to 525 to show that the numerical accuracy of this new implementation is competitive with that of the implementations of the divide and conquer and QL methods. GRA

N90-27378# RAND Corp., Santa Monica, CA.
GUIDE FOR THE MANAGEMENT OF EXPERT SYSTEMS DEVELOPMENT Interim Report
Iris Kameny, Umar Khan, Jody Paul, and David Taylor Jul. 1989 211 p
(Contract MDA903-85-C-0030)
(AD-A221847; RAND/R-3766-P/L; ISBN-08330-0991-5) Avail: NTIS HC A10/MF A02 CSCL 12/5

Risk managed application of expert systems (ES) technology is examined. Two problems that have frustrated managers and technicians who might otherwise be interested in exploring ES

solutions are the seeming lack of a software engineering discipline for creating and maintaining expert systems and the fact that the software development risks associated with expert systems have not been clearly addressed. This guide focuses on ES development as a software engineering endeavor and emphasizes that, as such, it should be subject to much the same discipline as conventional automated information system software. The guide is meant to be used in conjunction with accepted software development methods and standards, such as Department of Defense (DOD) Standards 2167A and 7935.1, DOD Directive 7920.1, DOD Instruction 7920.2, and the OSD Major Automated System Review Council (MAISRC) Guidelines for Program Managers. A step-by-step guideline is presented which addresses the managerial and technical risks of each phase in the software development life cycle of systems that contain ES components. GRA

N90-27379# Grenoble-1 Univ. (France). Techniques de l'Informatique, des Mathematiques, de la Microelectronique et de la Microscopie Quanti
STUDY OF THE FEASIBILITY OF SEVERAL MIXTURES [ETUDE DE LA FAISABILITE DE PLUSIEURS MELANGES]
B. Lacolle and P. Valentin May 1989 62 p In FRENCH; ENGLISH summary
(IMAG-RR-776-M; ETN-90-97222) Avail: NTIS HC A04/MF A01

An approach to stock management problem is studied. The aim of the work is to produce a mixture whose composition is known by mixing given basic mixtures. An important example is the management of demands in an oil refinery. The mixing procedures yield to the theory of geometric management of mixtures. The concept of a convex set of mixtures, known as a zonotope, is used. The production of several known mixtures are considered. Theoretical and practical aspects of this problem are analyzed. ESA

N90-27380# Grenoble-1 Univ. (France). Lab. ARTEMIS.
CONTEXT PROPAGATION TRUTH MAINTENANCE SYSTEM
Jerome Euzenat May 1989 44 p In FRENCH; ENGLISH summary
(RR-779-I; ETN-90-97233) Avail: NTIS HC A03/MF A01

A truth maintenance system designed to combine the advantages of both propagation oriented truth maintenance systems and context oriented systems is described. It maintains a dependency graph over the objects manipulated by a problem solver, and propagates the context in which the nodes are valid through it. The contexts take into account knowledge base incompleteness and allow for non-monotonic interferences. Contexts are interpreted theoretically ensuring good context properties while manipulated by implementation. The system ensures consistency of manipulated contexts and is able to answer requests taking several contexts into account simultaneously. ESA

N90-27381# Technische Univ., Berlin (Germany, F.R.). Fachbereich Informatik.
CONCEPTUAL DESIGN OF AN INTEGRATED SYSTEM FOR SOFTWARE SYSTEMS DESIGN IMPLEMENTATION AND TESTING Ph.D. Thesis [KONZEPTION EINES INTEGRIERTEN COMPUTERGESTUETZEN SYSTEMS FUER ENTWURF, IMPLEMENTIERUNG UND TEST VON SOFTWARE]
Rainer M. Gerkens 1989 172 p In GERMAN; ENGLISH summary
(ETN-90-97318) Avail: NTIS HC A08/MF A01

A system allowing for software program testing against a formal specification rather than against the program itself is described. A method of formal specification is presented and compared with the state of the art. System components are discussed allowing for an implementation of specific programs in a simple way by using generators for high level programming languages. A study of available test methods is presented. A computer aided test system which uses information collected at the specification and implementation phase is described. ESA

N90-27382 Politecnico di Milano (Italy). Dipt. di Elettronica.
THE IMAGE OF WEIGHTED COMBINATORIAL PROBLEMS
P. M. Camerini, G. Galbiati, and F. Maffioli 1988 19 p Sponsored in part by Italian Ministry of Public Education
(Grant NATO-RG-85-0240)
(Rept-88-017; ETN-90-97357) Avail: Politecnico di Milano, Laboratorio di Calcolatori, Dipartimento di Elettronica, Piazza Leonardo da Vinci 32, 20133 Milan, Italy

The concept of image of an integrally weighted combinatorial problem is introduced as the vector of all possible weights of feasible solutions. This preliminary work begins to explore the possible applications of this concept and to study the computational complexity of image computations. It is shown that the images of spanning trees, matroid bases, perfect matchings and, more generally, matroid parity bases can be computed in polynomial time for some bottleneck objective functions (such as, for instance, the maximum weight of an element), whereas (random) pseudo-polynomial time is needed when the objective function is the sum of the element weights. ESA

N90-27383 National Physical Lab., Teddington (England). Div. of Information Technology and Computing.
RAPID PROTOTYPING OF FORMAL SPECIFICATIONS USING MIRANDA
G. ONeill Nov. 1989 31 p
(NPL-DITC-150/89; ISSN-0262-5369; ETN-90-97378) Copyright Avail: National Physical Laboratory, Teddington, Middlesex, TW11 0LW, United Kingdom

The use of the functional programming language Miranda is discussed. It is used in the early stages of the software lifecycle to produce executable versions of formal specifications. Two examples are given: The first illustrates a rapid-prototyping approach in which the user requirements and the formal specifications of a small database system are developed together by means of a Miranda prototype. The second illustrates the animation of the VDM computer language specifications using Miranda. Objections which may be made to the methods used are summarized and addressed. ESA

62 COMPUTER SYSTEMS

Includes computer networks and special application computer systems.

N90-27384*# National Aeronautics and Space Administration. Pasadena Office, CA.
ANALOG HARDWARE FOR LEARNING NEURAL NETWORKS Patent Application
Silvio P. Eberhart, inventor (to NASA) (Jet Propulsion Lab., California Inst. of Tech., Pasadena.) 28 Dec. 1989 19 p
(Contract NAS7-918)
(NASA-Case-NPO-17664-1-CU; NAS 1.71:NPO-17664-1-CU; US-Patent-Appl-SN-463720) Avail: NTIS HC A03/MF A01 CSCL 09B

This is a recurrent or feedforward analog neural network processor having a multi-level neuron array and a synaptic matrix for storing weighted analog values of synaptic connection strengths which is characterized by temporarily changing one connection strength at a time to determine its effect on system output relative to the desired target. That connection strength is then adjusted based on the effect, whereby the processor is taught the correct response to training examples connection by connection. NASA

N90-27385*# National Aeronautics and Space Administration. Pasadena Office, CA.
NEURAL NETWORK WITH DYNAMICALLY ADAPTABLE NEURONS Patent Application
Raoul Tawel, inventor (to NASA) (Jet Propulsion Lab., California Inst. of Tech., Pasadena.) 31 Jan. 1990 28 p
(Contract NAS7-918)
(NASA-Case-NPO-17803-1-CU; NAS 1.71:NPO-17803-1-CU;

US-Patent-Appl-SN-473024) Avail: NTIS HC A03/MF A01 CSCL 09B

This invention is an adaptive neuron for use in neural network processors. The adaptive neuron participates in the supervised learning phase of operation on a co-equal basis with the synapse matrix elements by adaptively changing its gain in a similar manner to the change of weights in the synapse elements. In this manner, training time is decreased by as much as three orders of magnitude. NASA

N90-27386*# Maryland Univ., College Park. Inst. for Advanced Computer Studies.

PLACE/TRANSITION NETS WITH DEBIT ARCS

P. David Stotts and Parke Godfrey Apr. 1990 13 p Sponsored by NASA, Goddard Space Flight Center and Army Inst. for Research in Management Information and Computer Sciences, Atlanta, GA

(NASA-CR-186932; NAS 1.26:186932; AD-A222724; UMIACS-TR-90-54; CS-TR-2454) Avail: NTIS HC A03/MF A01 CSCL 12/1

An extension called debit arcs was added to traditional place/transition nets. A debit arc allows its destination transition to fire whenever desired, but records a debt (or antitoken) in its source place if a token there is not consumed. A normal token can annihilate with an antitoken, which can be though of as paying off the debt. Two natural rules for token/antitoken annihilation (instantaneous, and delayed) are examined and are shown to create two distinct classes of automation in terms of language recognition power. Under instantaneous annihilation, nets with debit arcs are equivalent as a class to Turing machines, and so extend the modeling power of standard place/transition nets, and thus are only a notational convenience. Nets with debit arcs are shown to be a special case of colored nets. GRA

N90-27387# Brown Univ., Providence, RI. Center for Neural Science.

A NEURAL NETWORK FOR FEATURE EXTRACTION

Nathan Intrator Mar. 1990 9 p

(Contract DAAG29-84-K-0202)

(AD-A223059; ARO-22000.13-LS) Avail: NTIS HC A02/MF A01 CSCL 12/9

A statistical framework is suggested for the parameter estimation problem associated with unsupervised learning in a neural network, leading to an exploratory projection pursuit network that performs feature extraction, or dimensionality reduction. The search for a possible presence of some unspecified structure in a high dimensional space can be difficult due to the curse of dimensionality problem, namely the inherent sparsity of high dimensional spaces. Due to this problem, uniformly accurate estimations for all smooth functions are not possible in high dimensions with practical sample sizes. Recently, exploratory projection pursuit (PP) has been considered (Jones, 1983) as a potential method for overcoming the curse of dimensionality problem and new algorithms were suggested by Friedman and by Hall. The idea is to find low dimensional projections that provide the most revealing views of the full-dimensional data emphasizing the discovery of nonlinear effects such as clustering. Many of the methods of classical multivariate analysis turn out to be special cases of PP methods. Examples are principal component analysis, factor analysis, and discriminant analysis. The various PP methods differ by the projection index optimized. GRA

N90-27388# Illinois Univ., Urbana. Center for Supercomputing Research and Development.

CSRD PARALLEL SERVICE MACHINE ENHANCEMENT Final Report, 1 Dec. 1988 - 30 Nov. 1989

David J. Kuck 30 Nov. 1989 9 p

(Grant AF-AFOSR-0166-89; AF Proj. 3842)

(AD-A221951; AFOSR-90-0463TR) Avail: NTIS HC A02/MF A01 CSCL 12/7

The three major areas in which the Center for Supercomputing Research and Development (CRSD) has performed research involving DOD support are: (1) Parallel Computer Systems Design Evaluation and Simulation Environment; (2) Automatic Restructuring and Concurrent Evaluation of Lisp; and (3) Parallel Iterative Solver for Sparse Nonsymmetric Linear Systems. This proposal requested funds to procure additional processors for the Cedar computer system (KLSD84). These funds enhanced the research capability of CSRD to perform research in the above mentioned areas. Also procured were disk drives to enhance the storage capacity of this system. GRA

N90-27389# Pennsylvania State Univ., University Park. Dept. of Computer Science.

PRACTICAL ISSUES IN THE COMPLEXITY OF NEURAL NETWORKS Final Technical Report, 1 Dec. 1988 - 30 Nov. 1989

Ian Parberry, Piotr Berman, and Georg Schnitger 29 Jan. 1990 9 p

(Grant AF-AFOSR-0168-89; AF Proj. 3842)

(AD-A221420; AFOSR-90-0385TR) Avail: NTIS HC A02/MF A01 CSCL 12/7

The equipment purchased under this Grant was used to supplement the theoretical work done under AFOSR-87-0400 with experimental results. The primary use of the equipment was to perform experiments to aid in the generation and testing of theoretical hypotheses about neural networks, regarding the magnitude of synaptic weights, convergence of learning algorithms, computation and learning with bounded-precision analog neural networks, the performance of simulated annealing on structured problems, and the management of replicated data bases. Research is still underway to gather more experimental data and provide theoretical justification for the observations. GRA

N90-27390# Maryland Univ., College Park. Inst. for Advanced Computer Studies.

ON PARALLEL HASHING AND INTEGER SORTING

Yossi Matias and Uzi Vishkin Jan. 1990 31 p Prepared in cooperation with Tel-Aviv Univ., Israel

(Contract N00014-85-0046; NSF CCR-89-0649)

(AD-A221569; UMIACS-TR-90-13; CS-TR-2395) Avail: NTIS HC A03/MF A01 CSCL 12/1

The problem of sorting n integers from a restricted range (1..m), where m is superpolynomial in n, is considered. An o(n log n) randomized algorithm is given. The algorithm takes O(n log log m) expected time and O(n) space. (Thus, for m = n sub polylog(m) we have an O(n log log n) algorithm.) The algorithm is parallelizable. The resulting parallel algorithm achieves optimal speed up. Some features of the algorithm make us believe that it is relevant for practical applications. A result of independent interest is a parallel hashing technique. The expected construction time is logarithmic using an optimal number of processors, and searching for a value takes O(1) time in the worst case. This technique enables drastic reduction of space requirements for the price of using randomness. Applicability of the technique is demonstrated for the parallel sorting algorithm, and for some parallel string matching algorithms. The parallel sorting algorithm is designed for a strong and non standard model of parallel computation. Efficient simulations of the strong model on a CRCW PRAM (Concurrent Read Concurrent Write Parallel Random Access Machine) are introduced. One of the simulations even achieves optimal speed up. This is probably a first optimal speed up simulation of a certain kind. GRA

N90-27391# Massachusetts Inst. of Tech., Cambridge.

CRITICAL PROBLEMS IN VERY LARGE SCALE COMPUTER SYSTEMS Semiannual Technical Report, 1 Oct. 1989 - 31 Mar. 1990

Anant Agarwal, William J. Dally, Srinivas Devadas, Thomas F. Knight, Jr., F. T. Leighton, Charles E. Leiserson, Jacob K. White, and John L. Wyatt, Jr. 31 Mar. 1990 71 p

(Contract N00014-87-K-0825)

(AD-A221603) Avail: NTIS HC A04/MF A01 CSCL 12/7

The research vehicle for this contract is the largest possible computer that can be conceived for the mid to late 1990's. We call this machine an American Resource Computer or ARC. We imagine this machine to occupy several floors of a building. The nation could probably only afford one or two ARC's. The machine

will be used to solve large-scale scientific problems having both military and civilian applications. This investigation addresses the hardware technology, software techniques, algorithms, communications, processing elements, and applications. The study is determining the plausibility (not feasibility) of the machine. The technical challenges of such a machine serve as our guiding stimulus for the research carried out and reported here. GRA

N90-27392# Massachusetts Inst. of Tech., Cambridge. Lab. for Computer Science.
LEARNING BINARY RELATIONS AND TOTAL ORDERS
Sally A. Goldman, Ronald L. Rivest, and Robert E. Schapire May 1990 53 p
(Contract N00014-89-J-1988)
(AD-A221643; MIT/LCS/TM-413) Avail: NTIS HC A04/MF A01 CSCL 12/4

Learning a binary relation between two sets of objects or between a set and itself represents a binary relation between a set of size n and a set of size m as an n x m matrix of bits, whose (i,j) entry is 1 if and only if the relation holds between the corresponding elements of the two sets. Polynomial prediction algorithms for learning binary relations are present in an extended on-line learning model, where the examples are drawn by the learner, by a helpful teacher, by an adversary, or according to a uniform probability distribution on the instance space. Results are presented for the case that the matrix of the relation has at most k row types with upper and lower bounds on the number of prediction mistakes any prediction algorithm makes when learning such a matrix under the extended on-line learning model. A technique is described that simplifies the proof of expected mistake bounds against a randomly chosen query sequence. GRA

N90-27393# Rochester Univ., NY. Dept. of Computer Science.
DEBUGGING AND ANALYSIS OF LARGE-SCALE PARALLEL PROGRAMS Ph.D. Thesis
John M. Mellor-Crummey Sep. 1989 149 p
(Contracts DACA76-85-C-0001; N00014-87-K-0548; NSF CCR-87-04492)
(AD-A221678; TR-312) Avail: NTIS HC A07/MF A01 CSCL 12/5

One of the most serious problems in the development cycle of large-scale parallel programs is the lack of tools for debugging and performance analysis. Parallel programs are more difficult to analyze than their sequential counterparts for several reasons. First, race conditions in parallel programs can cause non-deterministic behavior, which reduces the effectiveness of traditional cyclic debugging techniques. Second, invasive, interactive analysis can distort a parallel program's execution beyond recognition. Finally, comprehensive analysis of a parallel program's execution requires collection, management, and presentation of an enormous amount of information. This dissertation addresses the problem of debugging and analysis of large-scale parallel programs executing on shared-memory multiprocessors. It proposes a methodology for top-down analysis of parallel program executions that replaces previous ad-hoc approaches. To support this methodology, a formal model for shared-memory communication among processes in a parallel program is developed. It is shown how synchronization traces based on this abstract model can be used to create indistinguishable executions that form the basis for debugging. This result is used to develop a practical technique for tracing parallel program executions on shared-memory parallel processors so that their executions can be repeated deterministically on demand. GRA

N90-27394# Massachusetts Inst. of Tech., Cambridge. Artificial Intelligence Lab.
PARALLEL ALGORITHMS FOR COMPUTER VISION Final Report, 31 Aug. 1988 - 31 Jan. 1990
Tomaso Poggio Apr. 1990 64 p
(Contract DACA76-85-C-0010)
(AD-A221871; ETL-0564) Avail: NTIS HC A04/MF A01 CSCL 12/6

An integrated vision system, (the Vision Machine) based on a parallel supercomputer, is examined. The core of the Vision Machine is in fact a set of parallel algorithms for visual recognition and navigation in an unstructured environment. The present version of the Vision Machine was demonstrated to process images in close to real time by: (1) computing first several low level cues, such as edges, stereo disparity, optical flow, color and texture, (2) integrating them to extract a cartoon-like description of the scene in terms of the physical discontinuities of surfaces, and (3) using this cartoon in a recognition stage, based on parallel model matching. In addition to the development of the parallel algorithms, their implementation and testing, work was performed in several areas that are very closely related. These include: (1) design and fabrication of VLSI circuits to transfer to potentially cheap and fast hardware some of the software algorithms; (2) initial development of techniques to synthesize by learning vision algorithms; and (3) several projects involving autonomous navigation of small robots. GRA

63 CYBERNETICS

Includes feedback and control theory, artificial intelligence, robotics and expert systems.

For related information see also *54 Man/System Technology and Life Support.*

N90-27395*# Houston Univ., Clear Lake, TX. Research Inst. for Computing and Information Systems.
ROBOTIC SPACE SIMULATION INTEGRATION OF VISION ALGORITHMS INTO AN ORBITAL OPERATIONS SIMULATION
Daniel C. Bochsler (LinCom Corp., Houston, TX.) 30 Oct. 1987 79 p
(Contract NCC9-16)
(NASA-CR-185934; NAS 1.26:185934) Avail: NTIS HC A05/MF A01 CSCL 09B

In order to successfully plan and analyze future space activities, computer-based simulations of activities in low earth orbit will be required to model and integrate vision and robotic operations with vehicle dynamics and proximity operations procedures. The orbital operations simulation (OOS) is configured and enhanced as a testbed for robotic space operations. Vision integration algorithms are being developed in three areas: preprocessing, recognition, and attitude/attitude rates. The vision program (Rice University) was modified for use in the OOS. Systems integration testing is now in progress. B.G.

N90-27396# Science Applications International Corp., McLean, VA. Foreign Applied Sciences Assessment Center.
SOVIET IMAGE PATTERN RECOGNITION RESEARCH
B. L. McKenney, ed. and M. McGrain, ed. Dec. 1989 158 p
(Contract DE-AI01-83ER-3005)
(DE90-010912; FASAC-TAR-90010912) Avail: NTIS HC A08/MF A01

This report is an assessment of the published Soviet image pattern recognition (IPR) research and was written by a panel of six U.S. academic experts in that research field. Image pattern recognition is a set of technological research topics involving automatic or interactive computer processing of pictorial information, utilizing optical, electronic, and computer technologies. This report focuses on IPR system configuration (optical, hybrid, digital), and current research. The topical chapter headings are Image Processing Hardware and Software Preprocessing, Statistical Pattern Recognition, Computer Vision, and Optical Techniques and Systems. Soviet research in all areas of IPR is strong in theory, but limited by poor availability of equipment for generating and handling digital images, and digital computer hardware and software. Nevertheless, some Soviet IPR achievements compare favorably with those of the West. There is strong Soviet research in statistical pattern recognition, where fundamental relationships related to the factors determining error rates in classification of images are being developed. There has been good Soviet work in enhancement and restoration of images (visible and radar) of

the surface of Venus. There is a strong Soviet development program in optics and optical processing related to IPR. Nevertheless, the state of Soviet research in computer vision is ten to fifteen years behind the West, because of the lack of adequate hardware and software. The Soviet scientists in the area appear competent and knowledgeable of Western work, so that any improvement in their research output would be derived from access to more capable equipment. DOE

N90-27397# Drexel Univ., Philadelphia, PA.
DESIGN OF ROBUST MULTIVARIABLE CONTROLLERS Final Report, 5 Apr. 1988 - 13 Apr. 1990
Borchin C. Chang Apr. 1990 111 p
(Contract F33615-88-C-3600; AF Proj. 2304)
(AD-A222096; WRDC-TR-90-3006) Avail: NTIS HC A06/MF A01 CSCL 01/4

Two major problems, the solution of H infinity optimization problem and the computation of the real structured singular value, are addressed. The observer based controller parameterization, inner-outer factorization, and a state space size reduction technique were used to simplify the H infinity formulation and a fast gamma-iteration algorithm was proposed to compute the optimal H infinity norm of a 2-Block problem. The DGKF's two-riccati equation method was employed to design a nearly H infinity optimal controller for a 4-Block problem. An iterative approach for computing the real structured singular value was developed based on a multilinear mapping from the parameter space to the coefficient space, edge theorem, parameter domain partitioning, and a fast stability checking of the segment of a polytope. GRA

N90-27398# Army Missile Command, Redstone Arsenal, AL.
NEURAL NETWORKS Final Technical Report
John L. Johnson and C. C. Sung (Alabama Univ., Huntsville.) Jan. 1990 53 p Prepared in cooperation with Battelle Columbus Labs, Durham, NC
(Contract DAAL03-86-D-0001)
(AD-A222110; AD-E951452; AMSMI-CR-RD-RE-89-1) Avail: NTIS HC A04/MF A01 CSCL 12/9

Fundamental properties of neutral networks are discussed and five major models are presented. The emphasis is on the functional interpretation of the describing equations, and includes the nodal activity, learning laws, nonlinear response, stability and overall application areas. Optical implementations by intrinsic nonlinear effects are discussed in detail. Conceptual architectures for the major neural models are presented using optical building blocks for the subsystems. Full concurrent adaptive activity is explicitly included. GRA

N90-27399# Minnesota Univ., Minneapolis. Dept. of Electrical Engineering.
GENERALIZED INTERPOLATION THEORY FOR THE DESIGN AND ANALYSIS OF ROBUST FEEDBACK SYSTEMS Final Report, 1 Oct. 1987 - 31 Mar. 1990
Pramod P. Khargonekar and Allen R. Tannenbaum 11 May 1990 30 p
(Grant AF-AFOSR-0020-88; AF Proj. 2304)
(AD-A222130; AFOSR-90-0627TR) Avail: NTIS HC A03/MF A01 CSCL 20/3

A brief summary is given of the work done by the PIs and their students on the design and analysis of robust feedback systems. Research was conducted on a number of problems in system and control theory. In particular, new results were obtained on H infinity control theory, robust stability analysis of feedback systems, robust stabilization of uncertain systems, approximation and control of infinite dimensional systems, etc. A brief summary of the main results obtained are presented. GRA

N90-27400# Maryland Univ., College Park. Dept. of Electrical Engineering.
MULTIPROCESSOR REALIZATION OF NEURAL NETWORKS Ph.D. Thesis
Robert William Bennington 1990 348 p Sponsored by AFIT, Wright-Patterson AFB, OH
(AD-A222146; AFIT/CI/CIA-90-010) Avail: NTIS HC A15/MF A02 CSCL 12/7

This research provides a foundation for implementing neural networks on multiprocessor systems in order to increase execution speeds and to accommodate more complex neural networks. The emphasis is on the use of affordable coarse grain multiprocessors to implement commercially available neural network simulators currently being run on single processor systems. A conceptual framework is presented based on the concepts of program decomposition, load balancing, communication overhead, and process synchronization. Four methodologies are then presented for optimizing execution times. A set of metrics is also introduced which make it possible to measure the performance enhancements over single processor systems, and analyze the effects of communications overhead, load balancing, and synchronization for various network decompositions. The application of these four methodologies to two neural network simulators on a multiprocessor computer system is discussed in detail. They are illustrated with practical implementations of networks ranging in size from six to twenty thousand connections. Two of the methodologies, the Pipeline and Hybrid approaches, exhibit speedups approaching the possible upper limits. The theoretical significant of this dissertation research is that is provides a basis for achieving efficient multiprocessor implementation of highly and massive neural networks. GRA

N90-27401# Carnegie-Mellon Univ., Pittsburgh, PA. Robotics Inst.
THE OPERATIONAL FEATURE EXCHANGE LANGUAGE
David Alan Bourne, Jeff Baird, Paul Erion, and Duane T. Williams Mar. 1990 140 p
(Contract F33615-86-C-5038)
(AD-A222497; CMU-RI-TR-90-06) Avail: NTIS HC A07/MF A01 CSCL 12/5

This collection of documents describes the existing Feature Exchange Language (FEL) as it is implemented in the prototype Intelligent Machining Workstation (IMW). The original design of FEL is described, the FEL interface to several IMW subsystems (Planning, Modeling, and Holding) is explained in considerable detail, and the implementations for both the Sun Unix C++ and the TI Explorer Lisp environments are explained. FEL has been designed as a language for communicating messages in a distributed environment. FEL was designed to make parsing and generation simple. The assumption was that possibly many different computing platforms would require an FEL interpreter. It was assumed that FEL could tie together processes running on one machine or many, and therefore FEL was designed to represent the sender, receiver(s) and other information that could be useful in message transport. Features were chosen as the objects that should be communicated. Each feature has a name and a set of built in parameters that go with it. Each sentence of FEL has a verb that specifies how a message should be interpreted by a particular receiver. FEL was designed to represent complex message exchanges between distributed parties. GRA

N90-27402# Peritus, Inc., Norwood, NJ.
DEVELOPMENT, IMPLEMENTATION, AND VALIDATION OF CONTROL ALGORITHMS FOR THE DUAL-ARM ROBOTIC MANIPULATION OF A SINGLE OBJECT Final Report, Feb. - Dec. 1989
S. J. Tricamo, F. L. Swern, and N. P. Coleman May 1990 71 p
(Contract DAAL03-86-D-0001)
(AD-A222502; ARFSD-CR-90004) Avail: NTIS HC A04/MF A01 CSCL 12/9

The objective was to develop and validate control algorithms for the dual-arm robotic manipulation of a single object. The specific tasks performed to attain the objective were: (1) Prepare control boards suitable for the processing and data handling necessary for the dual arm robotic manipulation of a single object using wrist mounted force/torque sensors as feedback devices; (2) Devise and implement a means for estimating the weight of the

gripped object and eliminating that reaction from the individual force/torque transducer readings; (3) Implement an interface with an external vision system that is to be used to locate the initial position and orientation of the object to be manipulated and, using that input, individually guide each arm to an initial grip point; (4) Implement a technique for removing any initial misalignment existing between either gripper and the gripped object; (5) Implement a control technique to allow the trajectory of one of the cooperating manipulators to adapt to any misalignment error occurring during the dual arm manipulation of the object; (6) Validate the control algorithm and develop a working demonstration of the control approach; and (7) Document all control software and test results. GRA

N90-27403# Carnegie-Mellon Univ., Pittsburgh, PA. Dept. of Computer Science.
THE DEVELOPMENT OF THE TIME-DELAYED NEURAL NETWORK ARCHITECTURE Final Report
Geoffrey Hinton (Toronto Univ., Ontario), James L. McClelland, and Kevin J. Lang 20 Apr. 1990 56 p
(Contract N00014-86-K-0167)
(AD-A221540) Avail: NTIS HC A04/MF A01 CSCL 25/4

Currently, one of the most powerful connectionist learning procedures is back-propagation which repeatedly adjusts the weights in a network so as to minimize a measure of the difference between the actual output vector of the network and a desired output vector given the current input vector. The simple weight adjusting rule is derived by propagating partial derivatives of the error backwards through the net using the chain rule. Experiments have shown that back-propagation has most of the properties desired by connectionists. As with any worthwhile learning rule, it can learn non-linear black box functions and make fine distinctions between input patterns in the presence of noise. Moreover, starting from random initial states, back-propagation networks can learn to use their hidden (intermediate layer) units to efficiently represent the structure that is inherent in their input data, often discovering intuitively pleasing features. The fact that back-propagation can discover features and distinguish between similar patterns in the presence of noise makes it a natural candidate as a speech recognition method. Another reason for expecting back-propagation to be good at speech is the success that hidden Markov models have enjoyed in speech can be useful when there is a rigorous automatic method for tuning its parameters. GRA

N90-27404# Johns Hopkins Univ., Baltimore, MD. Dept. of Electrical Engineering and Computer Science.
ANALYSIS AND DESIGN METHODS FOR NONLINEAR CONTROL SYSTEMS Final Report, 1 Mar. 1987 - 28 Feb. 1990
Wilson J. Rugh Mar. 1990 7 p
(Grant AF-AFOSR-0101-87; AF Proj. 2304)
(AD-A221621; AFOSR-90-0447TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

Research results are briefly described on the analysis and design of nonlinear control systems obtained. The main focus of the research was on a new approach for designing nonlinear control laws that is called design by extended linearization. Results reported include a method for designing nonlinear controllers of proportional integral-derivative type, a method for designing nonlinear control laws that achieve asymptotic tracking of reference signals and rejection of disturbance signals for nonlinear plants, and a method for achieving approximate noninteraction with stability in cases where exact noninteraction with stability cannot be achieved. Technical publications describing these and other results are listed. GRA

N90-27405# Air Force Systems Command, Wright-Patterson AFB, OH. Foreign Technology Div.
COLLECTIVE COMPUTATION OF NEURAL NETWORK
Guozheng Yao and Yunjiu Wang 15 Mar. 1990 29 p Transl. into ENGLISH from Xinxi Yu Kongzhi (Peoples Republic of China), v. 18, no. 2(97), 1989 p 31-40
(Contract F33657-88-D-2188)
(AD-A221848; FTD-ID(RS)T-0961-89) Avail: NTIS HC A03/MF A01 CSCL 12/9

Computational neuroscience is a new branch of neuroscience originating from current research on the theory of computer vision. The goal of the branch is to find a new interdisciplinary approach to dealing with information processing in the brain. The research involves scientists working in artificial intelligence engineering and neuroscience. The collective computational properties of model neural networks are introduced, mainly in a theoretical framework of neural network computational properties advanced by Hopfield and its application to vision research. On this basis, the authors analyzed the significance of the Hopfield model. GRA

N90-27406# Universitaet der Bundeswehr Muenchen, Neubiberg (Germany, F.R.). Inst. fuer Systemdynamic und Flugmechanik.
DYNAMIC MONOCULAR MACHINE VISION AND APPLICATIONS OF DYNAMIC MONOCULAR MACHINE VISION
Ernst Dieter Dickmanns and Volker Graefe Jul. 1988 99 p Sponsored in part by BMFT; DFG; Daimler Benz A.G.; and MBB
(LRT-WE-13-FB-88-3; ETN-90-97334) Avail: NTIS HC A05/MF A01

A new approach to realtime machine vision in dynamic scenes is presented. It is based on special hardware and methods for feature extraction and information processing. Using integral spatio-temporal models, it bypasses the nonunique inversion of the perspective projection by applying recursive least squares filtering. By prediction error feedback methods, all spatial states variables including the velocity components are estimated. Only the last image of the sequence needs to be evaluated. Two applications in the field of robotics are given. ESA

N90-27277*# Space Telescope Science Inst., Baltimore, MD.
SPIKE: ARTIFICIAL INTELLIGENCE SCHEDULING FOR HUBBLE SPACE TELESCOPE
Mark Johnston, Glenn Miller, Jeff Sponsler, Shon Vick, and Robert Jackson (Computer Sciences Corp., Baltimore, MD.) *In* NASA, Marshall Space Flight Center, Fifth Conference on Artificial Intelligence for Space Applications May 1990 p 11-18 (For primary document see N90-27275 21-61)
Avail: NTIS HC A25/MF A04 CSCL 09B

N90-27279*# Arizona Univ., Tucson. AI-Simulation Group.
DEVS-BASED INTELLIGENT CONTROL OF SPACE ADAPTED FLUID MIXING
Sung-Do Chi and Bernard P. Zeigler *In* NASA, Marshall Space Flight Center, Fifth Conference on Artificial Intelligence for Space Applications May 1990 p 25-32 (For primary document see N90-27275 21-61)
(Contract NCC2-525)
Avail: NTIS HC A25/MF A04 CSCL 09B

N90-27280*# Martin Marietta Corp., Denver, CO.
DYNAMIC TEST INPUT GENERATION FOR MULTIPLE-FAULT ISOLATION
Phil Schaefer *In* NASA, Marshall Space Flight Center, Fifth Conference on Artificial Intelligence for Space Applications May 1990 p 33-42 (For primary document see N90-27275 21-61)
Avail: NTIS HC A25/MF A04 CSCL 09B

N90-27281*# Bureau of Mines, Tuscaloosa, AL. Research Center.
GENETIC ALGORITHM BASED FUZZY CONTROL OF SPACECRAFT AUTONOMOUS RENDEZVOUS
C. L. Karr, L. M. Freeman, and D. L. Meredith (Alabama Univ., Tuscaloosa.) *In* NASA, Marshall Space Flight Center, Fifth Conference on Artificial Intelligence for Space Applications May 1990 p 43-51 (For primary document see N90-27275 21-61)
Avail: NTIS HC A25/MF A04 CSCL 09B

N90-27282*# Spectra Research Systems, Inc., Huntsville, AL.
THE APPLICATION OF INTELLIGENT PROCESS CONTROL TO SPACE BASED SYSTEMS
G. Steve Wakefield *In* NASA, Marshall Space Flight Center, Fifth Conference on Artificial Intelligence for Space Applications

May 1990 p 53-58 (For primary document see N90-27275 21-61)
Avail: NTIS HC A25/MF A04 CSCL 09B

N90-27283*# Alabama Univ., Huntsville.
ARTIFICIAL INTELLIGENCE IN THE MATERIALS PROCESSING LABORATORY
Gary L. Workman and William F. Kaukler *In* NASA, Marshall Space Flight Center, Fifth Conference on Artificial Intelligence for Space Applications May 1990 p 59-67 (For primary document see N90-27275 21-61)
(Contract NAS8-36955)
Avail: NTIS HC A25/MF A04 CSCL 09B

N90-27284*# FMC Corp., Santa Clara, CA. Corporate Technology Center.
AN ARCHITECTURE FOR INTELLIGENT TASK INTERRUPTION
D. D. Sharma and Srini Narayan *In* NASA, Marshall Space Flight Center, Fifth Conference on Artificial Intelligence for Space Applications May 1990 p 69-84 (For primary document see N90-27275 21-61)
Avail: NTIS HC A25/MF A04 CSCL 09B

N90-27291*# Alabama Univ., Huntsville.
ESTABLISHING A COMMUNICATIONS-INTENSIVE NETWORK TO RESOLVE ARTIFICIAL INTELLIGENCE ISSUES WITHIN NASA'S SPACE STATION FREEDOM RESEARCH CENTERS COMMUNITY
E. Davis Howard, III *In* NASA, Marshall Space Flight Center, Fifth Conference on Artificial Intelligence for Space Applications May 1990 p 139-145 (For primary document see N90-27275 21-61)
(Contract NAS8-36955)
Avail: NTIS HC A25/MF A04 CSCL 09B

N90-27301*# Symbolics, Inc., Cambridge, MA.
A DEVELOPMENT FRAMEWORK FOR ARTIFICIAL INTELLIGENCE BASED DISTRIBUTED OPERATIONS SUPPORT SYSTEMS
Richard M. Adler and Bruce H. Cottman *In* NASA, Marshall Space Flight Center, Fifth Conference on Artificial Intelligence for Space Applications May 1990 p 231-240 (For primary document see N90-27275 21-61)
(Contracts NAS10-11606; DAAB10-87-C-0053)
Avail: NTIS HC A25/MF A04 CSCL 09B

N90-27302*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, AL.
A KNOWLEDGE BASE ARCHITECTURE FOR DISTRIBUTED KNOWLEDGE AGENTS
Joel Riedesel (Martin Marietta Corp., Huntsville, AL.) and Bryan Walls *In its* Fifth Conference on Artificial Intelligence for Space Applications May 1990 p 241-256 (For primary document see N90-27275 21-61)
(Contract NAS8-36433)
Avail: NTIS HC A25/MF A04 CSCL 09B

N90-27312*# Scientific Research Associates, Inc., Glastonbury, CT.
THE REAL-TIME LEARNING MECHANISM OF THE SCIENTIFIC RESEARCH ASSOCIATES ADVANCED ROBOTIC SYSTEM (SRAARS)
Alexander Y. Chen *In* NASA, Marshall Space Flight Center, Fifth Conference on Artificial Intelligence for Space Applications May 1990 p 331-340 (For primary document see N90-27275 21-61)
(Contract NAS7-1012)
Avail: NTIS HC A25/MF A04 CSCL 09B

N90-27320*# Army Missile Command, Redstone Arsenal, AL. Systems Simulation and Development Directorate.
A STRUCTURE FOR MATURING INTELLIGENT TUTORING SYSTEM STUDENT MODELS
Willard M. Holmes *In* NASA, Marshall Space Flight Center, Fifth Conference on Artificial Intelligence for Space Applications May 1990 p 421-428 (For primary document see N90-27275 21-61)
Avail: NTIS HC A25/MF A04 CSCL 09B

N90-27324*# Southwest Research Inst., San Antonio, TX.
INTELLIGENT TUTORING SYSTEMS FOR SPACE APPLICATIONS
Carol A. Luckhardt-Redfield *In* NASA, Marshall Space Flight Center, Fifth Conference on Artificial Intelligence for Space Applications May 1990 p 467-475 (For primary document see N90-27275 21-61)
Avail: NTIS HC A25/MF A04 CSCL 09B

N90-27334*# Intellicorp, Mountain View, CA.
COMPILING KNOWLEDGE-BASED SYSTEMS FROM KEE TO Ada
Robert E. Filman, Conrad Bock, and Roy Feldman *In* NASA, Marshall Space Flight Center, Fifth Conference on Artificial Intelligence for Space Applications May 1990 p 557-566 (For primary document see N90-27275 21-61)
(Contract NAS8-38036)
Avail: NTIS HC A25/MF A04 CSCL 09B

N90-27336*# Rockwell International Corp., Seal Beach, CA. Strategic Defense Center.
SDI SATELLITE AUTONOMY USING AI AND Ada
Harvey E. Fiala *In* NASA, Marshall Space Flight Center, Fifth Conference on Artificial Intelligence for Space Applications May 1990 p 577-588 (For primary document see N90-27275 21-61)
Avail: NTIS HC A25/MF A04 CSCL 09B

64 NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

N90-27407# Bendat (Julius S.) Co., Los Angeles, CA.
IDENTIFICATION TECHNIQUES FOR NONLINEAR DIFFERENTIAL EQUATIONS OF MOTION Final Report, Oct. 1988 - Mar. 1990
Julius S. Bendat, Paul A. Palo, and Robert N. Coppolino (Measurement Analysis Corp., Torrance, CA.) Mar. 1990 62 p
(Contract N62474-86-C-7275; NR Proj. RR0-0001)
(AD-A220895; NCEL-N-1810) Avail: NTIS HC A04/MF A01 CSCL 12/2

New nonlinear system stochastic techniques are developed and systematically demonstrated which determine the amplitude domain and frequency domain properties of nonlinear systems as described in proposed nonlinear differential equations of motion. From measurements of input excitation data and output response data, it is shown that this new method, based upon multiple-input/single-output (MI/SO) linear analysis of reverse dynamic systems, allows for the efficient identification of different non-linear systems. Nonlinear systems simulated here include Duffing, Van der Pol, Mathieu, and Dead-Band systems. GRA

N90-27408# Sheffield Univ. (England). Dept. of Control Engineering.
THE STABILITY OF DIFFERENTIAL SYSTEMS WITH DELAY
S. P. Banks and Zhang Yi (China Electronic Science and Technology Univ., Chengdu.) May 1990 16 p
(RR-377; ETN-90-97119) Avail: NTIS HC A03/MF A01

The stability of differential delay systems is investigated. A general criterion for stability is proven and an example of stability which cannot be checked by the criteria of Amemiya or Mori is given. A result is proven in terms of the coefficients of certain matrices which define the system. This result is applied to obtain a result for an nth order system in terms of the eigenvalues of the characteristic equation. An Msub2 space formulation and the example are provided. ESA

N90-27409*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.
PROJECTION METHODS FOR SOLVING NONLINEAR SYSTEMS OF EQUATIONS
Peter N. Brown (Lawrence Livermore National Lab., CA.) and Youcef Saad Apr. 1990 15 p Presented at the NATO Advanced Research Workshop on Defects, Singularities, and Patterns in Nematic Liquid Crystals, Orsay, France, 28 May - 1 Jun. 1990 Submitted for publication
(Contracts NCC2-387; W-7504-eng-48)
(NASA-TM-101878; NAS 1.15:101878; DE90-012990; UCRL-JC-103972; CONF-9005229-1) Avail: NTIS HC A03/MF A01 CSCL 12A

Several nonlinear projection methods based on Krylov subspaces are described and their convergence is analyzed. The prototype of these methods is a technique that generalizes the conjugate direction method by minimizing the norm of the function F over some subspace. The emphasis is on nonlinear least squares problems which can also be handled by this general approach. DOE

N90-27410# Oak Ridge National Lab., TN. Engineering Physics and Mathematics Div.
ON FINDING SUPERNODES FOR SPARSE MATRIX COMPUTATIONS
J. W. H. Liu (York Univ., Ontario), E. Ng, and B. W. Peyton Jun. 1990 15 p Sponsored in part by Canadian Natural Sciences and Engineering Research Council
(Contract DE-AC05-84OR-21400)
(DE90-013626; ORNL/TM-11563) Avail: NTIS HC A03/MF A01

A simple characterization of fundamental supernodes is given in terms of the row subtrees of sparse Cholesky factors in the elimination tree. Using this characterization, we present an efficient algorithm that determines the set of such supernodes in time proportional to the number of nonzeros and equations in the original matrix. Experimental results are included to demonstrate the use of this algorithm in the context of sparse supernodal symbolic factorization. DOE

N90-27411# North Carolina State Univ., Raleigh. Dept. of Mathematics.
CONJUGATE GRADIENT METHODS FOR CONSTRAINED LEAST SQUARES PROBLEMS Ph.D. Thesis
James Douglas 1990 137 p Sponsored by AFIT, Wright-Patterson AFB, OH
(AD-A222706; AD-E501236; AFIT/CI/CIA-90-013D) Avail: NTIS HC A07/MF A01 CSCL 12/3

In 1988, Barlow, Nichols, and Plemmons proposed an order-reducing conjugate gradient algorithm for solving constrained least squares problems. They proved that this method, which we call Algorithm (Barlow, Nichols, and Plemmons), is superior to p-cyclic (successive overrelaxation) in exact arithmetic. Here we continue the study of algorithm BNP. A source of instability was identified and corrected in the original algorithm, and develop a parallel version suitable for substrated problems. It was proved that BNP is superior to block accelerated overrelaxation (AOR), and establish a connection between BNP and a preconditioned form of the weighting method. It was also shown that BNP can be viewed as a nullspace method, in which a distinguished choice of the basis for the nullspace is used but never formed. Finally, this nullspace characterization was exploited to extend BNP, producing a class of algorithms called implicit nullspace methods. These methods allow great flexibility in the choice of preconditioner, and can be used to solve problems for which BNP is not well suited. Like BNP, the extensions are suitable for parallel implementation on substructured problems. Experiments on structural engineering and Stokes Flow models suggest that BNP and its extensions offer a competitive alternative to existing iterative algorithms for solving constrained least squares problems. The appendix describes a mechanism which can cause the breakdown of incomplete QR factorizations. GRA

N90-27412# City Coll. of the City Univ. of New York, NY.
CONSEQUENCES OF MONOTONICITY FOR MARKOV TRANSITION FUNCTIONS
Mark Brown 28 Feb. 1990 47 p
(Grant AF-AFOSR-0083-89; AF Proj. 2304)
(AD-A222852; CUNY-MB89-03; AFOSR-90-0580TR) Avail: NTIS HC A03/MF A01 CSCL 12/3

For an ergodic Markov chain conditions for, and consequences of, monotonicity were examined in time of a certain equation. The work has application to the study of asymptotic exponentiality of first passage time distributions, as well as the computation of separation distance. GRA

N90-27413# Air Force Academy, CO. Dept. of Mathematical Sciences.
A NUMBER-THEORETIC APPROACH TO SUBGROUPS OF DIHEDRAL GROUPS Final Report, Aug. 1989 - Apr. 1990
David W. Jensen and Michael K. Keane Apr. 1990 28 p
(AD-A222857; USAFA-TR-90-2) Avail: NTIS HC A03/MF A01 CSCL 12/2

Dihedral groups describe the symmetry of bounded figures in the plane. They are also the fundamental structures used to analyze the symmetry of more complicated objects like frieze patterns, wallpaper patterns, and three-dimensional crystals. This report investigates the subgroup structure of dihedral groups from a number theory point of view. The prerequisites needed to understand the material are modest. It is assumed that the reader is familiar with the group theory and number theory at the undergraduate level. The report presents the authors' research findings from August 1989 to March 1990. During that period, two papers were submitted for publication; they are reproduced here in chapters one and two. Footnotes have been added to clarify and expand the topics covered. Also, for those wishing to pursue the subject further, a section on open questions has been included, as well as an extended bibliography. The footnotes, open questions, and extended bibliography unify what otherwise might appear to be two disjoint papers. GRA

N90-27414# Naval Postgraduate School, Monterey, CA. Dept. of Mathematics.
ON DOMAIN DECOMPOSITION METHODS FOR SOLVING PARTIAL DIFFERENTIAL EQUATIONS
Beny Neta and Naotaka Okamota (Okayama Univ. of Science, Japan) 30 Mar. 1990 14 p
(AD-A222975; NPS53-90-004) Avail: NTIS HC A03/MF A01 CSCL 12/1

A domain decomposition method for solving partial differential equations is described. The conditions on interfaces will all be of Dirichlet type and obtained by the boundary element method using very few (less than 10) unknowns. GRA

N90-27415# Scripps Institution of Oceanography, La Jolla, CA.
SEPARABLE COORDINATE SYSTEMS FOR PDE
Freeman Gilbert and Craig Lindberg Jun. 1990 1 p
(Contract N00014-87-K-0191)
(AD-A223052) Avail: NTIS HC A01/MF A01 CSCL 12/1

Using the symmetry groups of the equations governing acoustic and electromagnetic scattering (the Helmholtz and vector Helmholtz equations, respectively) new methods were studied for separating the equations into ordinary differential equations and generating new classes of solutions in novel geometries. There are many methods for generating solutions to partial differential equations, including finite elements and finite difference numerical techniques. The oldest method, and one of the most powerful, is the method of separation of variables, invented by Bernoulli. Separation of variables is defined to mean the decomposition of a partial differential equation into a set of uncoupled ordinary differential equations. This is useful, as the solution of ordinary differential equations by numerical techniques is much easier and faster than the solution of partial differential equations. Two specific problems were attacked with these methods: electromagnetic scattering from paraboloidal surfaces; and acoustic wave interaction with unusual shapes. GRA

N90-27416# Syracuse Univ., NY. Dept. of Electrical and Computer Engineering.
TOEPLITZ MATRICES: ALGEBRA AND ALGORITHMS Final Report, Feb. 1987 - Jan. 1990
Hari Krishna 31 Mar. 1990 140 p
(Contract DAAL03-87-K-0027)
(AD-A223174; ARO-24941.16-MA-SDI) Avail: NTIS HC A07/MF A01 CSCL 12/5

In this research project, the mathematical structure and numerical algorithms associated with Toeplitz matrices are analyzed. Toeplitz matrices arise in a number of problems in engineering and applied mathematics. In many such problems, the task is to solve for certain parameters of interest (such as predictor polynomial, reflection coefficients, and solution to a linear system) in a computationally efficient manner. Also, the numerical stability aspects of the various algorithms must be examined from the standpoint of implementation using finite precision arithmetic. We have derived fast (order-recursive) and superfast (fast Fourier transform based) algorithms for solving a Toeplitz linear system. The algorithms reported here are some of the most computationally efficient algorithms. Also, the numerical stability of the split Levinson algorithm is examined and it is established that it is weakly stable. Furthermore the various classical and split Levinson algorithms are studied for the effects of finite precision arithmetic. An interesting relationship between Levinson algorithm and stability tests for discrete systems is exploited to derive a new computationally efficient algorithm for testing the wide sense stability of discrete time systems. GRA

N90-27417# Kent State Univ., OH. Dept. of Mathematical Sciences.
INVESTIGATIONS ON IMPROVED ITERATIVE METHODS FOR SOLVING SPARSE SYSTEMS OF LINEAR EQUATIONS Final Technical Report, 1 Jul. 1985 - 30 Sep. 1989
Richard S. Varga 30 Sep. 1989 5 p
(Grant AF-AFOSR-0245-85; AF Proj. 2304)
(AD-A221980; AFOSR-90-0548TR) Avail: NTIS HC A01/MF A01 CSCL 12/1

The basic aim of the research was to investigate, in depth, the optimization of iterative methods for solution of nonsymmetric nonpositive-definite matrix equations which arise in the numerical approximation (by finite difference or finite elements) of typical convection-diffusion problems. In the opinion of this Principal Investigator, the research results obtained were of sufficient quality to be published in leading technical journals. We list below published research papers associated in this period with this current research effort. GRA

N90-27418# Weizmann Inst. of Science, Rehovoth (Israel). Dept. of Applied Mathematics.
NUMERICAL SOLUTIONS TO STEADY-STATE PROBLEMS WITH DISCONTINUITIES Ph.D. Thesis
David Sidilkover Aug. 1989 81 p
(Grants AF-AFOSR-0127-86; AF-AFOSR-0126-86; NSF DMS-87-04169; AF Proj. 2304)
(AD-A222205; AFOSR-90-0579TR) Avail: NTIS HC A05/MF A01 CSCL 12/1

The long term systematic advance of multilevel computational methods has continued in 1989. Highly parallelizable multilevel techniques were developed for the following mathematical tasks: (1) Solution of general nonlinear PDE systems, including elliptic and nonelliptic, steady state and time dependent problems and inverse problems, pointing toward new type of multigrid solvers in fluid dynamics; (2) Fast integral transforms, including FFT on non-uniform grids; (3) Solution of integro-differential equations; (4) Fast multiplication by a dense matrix or its inverse, including O(n) calculation and solution of n body interactions; (5) Global optimization of systems with many local optima, including in particular discrete optimization; (6) Linear programming, at least for spatial problems; (7) Image restoration; (8) Computing behavior of statistical fields; fast calculation of thermodynamic limits; and (9) Derivation and super-fast updating of large determinants of grid equations, with special emphasis on Dirac equations. GRA

N90-27419# Rice Univ., Houston, TX. Dept. of Computer Science.
FINDING THE MAXIMUM RECOVERABLE SYSTEM STATE IN OPTIMISTIC ROLLBACK RECOVERY METHODS
David B. Johnson, Peter J. Keleher, and Willy Zwaenepoel 1989 11 p Presented at the 9th Symposium on Reliable Distributed Software, Oct. 1990
(Contract N00014-88-K-0140; NSF CDA-86-19893; NSF CCR-87-16914)
(AD-A222338) Avail: NTIS HC A03/MF A01 CSCL 12/7

In a distributed system using rollback recovery, information saved on stable storage during failure-free execution allows certain states of each process to be recovered after a failure. For example, in a deterministic system using message logging and checkpointing, a process state can be recovered only if all messages received by the process since its previous checkpoint have been logged. In a nondeterministic system using checkpointing alone, a process state can be recovered only if it has been recorded in a checkpoint. Optimistic rollback recovery methods in general record this information asynchronously, assuming that a suitable recoverable system state can be constructed for use during recovery. A system is called recoverable if and only if it is consistent and the state of each individual process in that system state can be recovered. It is shown that in any system using optimistic rollback recovery, there is always a unique maximum recoverable system state, extending the previous result for systems using message logging and checkpointing. A simple new algorithm is also presented for finding the maximum recoverable system state, and some experiences are described with its implementation. These results can be applied to deterministic and to nondeterministic systems. GRA

N90-27420# Yale Univ., New Haven, CT. Dept. of Computer Science.
PARALLEL PERFORMANCE OF DOMAIN-DECOMPOSED PRECONDITIONED KRYLOV METHODS FOR PDES WITH ADAPTIVE REFINEMENT
William D. Gropp (Argonne National Lab., IL.) and David E. Keyes Apr. 1990 18 p Submitted for publication
(Contracts N00014-86-K-0310; W-31-109-eng-38; NSF DCR-85-21451; NSF EET-87-07109; NSF ECS-89-57475)
(AD-A222339; YALEU/DCS/RR-773) Avail: NTIS HC A03/MF A01 CSCL 12/1

Preconditioners based on domain decomposition appear natural for the Krylov solution of implicitly discretized partial differential equations on parallel computers. Two-scale preconditioners (involving independent subdomain solves and a global crosspoint system, as well as independent solves over interfaces of lower physical dimension) have been known since the early 1980's to be near optimal in the sense of providing a bounded or at most logarithmically growing iteration count as the mesh is refined. However, overall computational complexity depends on the components of the preconditioner as well as the iteration count. The cost of exact subdomain solves grows superlinearly in arithmetic complexity, and that of the crosspoint system superlinearly in communication complexity. These factors make the preconditioner granularity and the choice of its components problem- and machine-dependent compromises. Numerical experiments are presented on both shared and distributed memory computers for convection-diffusion problems at modest Peclet (or Reynolds) numbers, without recirculation. Due to the development of boundary layers, these problems benefit from local mesh refinement, which is straightforward to accommodate within the domain decomposition framework in a locally uniform sense, but which introduces load balancing as a further consideration in choosing the granularity of the preconditioner. GRA

N90-27421# North Carolina Univ., Chapel Hill. Dept. of Statistics.
MULTI-HILBERTIAN SPACES AND THEIR DUALS
Milan J. Merkle (Belgrade Univ., Yugoslavia) Mar. 1990 54 p Submitted for publication

(Contract F49620-85-C-0144; AF Proj. 2304)
(AD-A222344; TR-291; AFOSR-90-0646TR) Avail: NTIS HC A04/MF A01 CSCL 12/3

In the last several years there has been a remarkable amount of work in probability on infinitely dimensional spaces, in particular on nuclear spaces. Although most of the work has been done in nuclear spaces, some of the basic theorems (for instance, Ito's regularization theorem), are given in a much more general context of multi-Hilbertian spaces. Topological properties were studied of multi-Hilbertian spaces and their duals, hoping that this will serve as an introduction to a study of probability problems on these spaces. An attempt was made to distinguish properties that are consequences of nuclearity from those that hold on non-nuclear spaces. A non-standard completion theorem is proposed, removing the condition of compatibility of norms, a condition that seems to be overlooked in most probability papers. Also, a detailed account is given on open, bounded, and compact sets. Elaborated proofs are left for appendices, and, as a result, appendices occupy a considerable space. This is mostly due to results related to seminorms that were made rigorous. The results that are given are selected with a purpose to serve as a basis for probability investigation; the topology alone was not the aim. GRA

N90-27422# Pittsburgh Univ., PA. Inst. for Computational Mathematics and Applications.
ON THE THEORY AND NUMERICS OF DIFFERENTIAL-ALGEBRAIC EQUATIONS
Werner C. Rheinboldt May 1990 40 p
(Contract N00014-90-J-1025; NSF CCR-89-07654)
(AD-A222427; ICMA-90-149) Avail: NTIS HC A03/MF A01 CSCL 12/1

This is a written version of a series of invited lectures on differential-algebraic systems of equations (DAEs) at the IVth SERC Numerical Analysis Summer School of Lancaster Univ. In line with the aims of the meeting these notes introduce some typical applications and basic properties of DAEs and then present an overview of recent, new existence theories for such systems based on differential geometric considerations and on a numerical approach derived from these theories. In the presentation the stress is on general concepts, results and applications rather than on detailed proofs. GRA

N90-27423# San Diego State Univ., CA.
CONTENT EFFECTS IN MATHEMATICS PROBLEM SOLVING Progress Report, 1 Jan. - 31 Mar. 1990
Sandra P. Marshall 31 May 1990 2 p
(Contract N00014-89-J-1393)
(AD-A222436) Avail: NTIS HC A01/MF A01 CSCL 12/1

During this period, we continued our examination of the effects of familiarity and stereotype in mathematics word problem solving by further analyzing the data from two experiments described in a previous report. Our data base was derived from the problem solving and rating performance of 128 college students, who were asked to solve sixteen word problems and rate those, and other similar problems, according to their personal familiarity and according to their perception of sex-stereotype of the situations described in the word problems. GRA

N90-27424# Texas A&M Univ., College Station. Electromagnetics and Microwave Lab.
APPLICATIONS OF GAUGE THEORIES TO ENHANCE NUMERICAL SOLUTIONS OF MIXED POTENTIAL INTEGRAL EQUATIONS Final Technical Report
Robert D. Nevels and Kelly J. Crowell 30 Apr. 1990 59 p
(Contract N00014-87-K-0193)
(AD-A221520) Avail: NTIS HC A04/MF A01 CSCL 20/3

The mixed potential electric field integral equation (MPIE) method is a widely used numerical method in wave scattering analysis. The MPIE and all other classical Maxwell equation scattering methods involving the scalar and vector potentials are based on the Lorentz gauge. In this report we analyze a series of waveguiding and scattering problems formulated by enforcing the Coulomb gauge. Coulomb gauge Green's functions are derived for a rectangular waveguide, free space, a cylinder and a wedge. With the MPIE method the currents on a scatterer are shown to be gauge independent. Comparisons are therefore made between the computation times necessary for calculating the current on a straight thin wire and arbitrary scatterers in the presence of a circular conducting cylinder and conducting wedge. Conclusions are drawn concerning the utility of the Coulomb gauge as compared to the Lorentz and other gauges. GRA

N90-27425# Georgia Inst. of Tech., Atlanta. School of Information and Computer Science.
QUEING NETWORKS WITH FINITE CAPACITIES Final Report, 1 Nov. 1987 - 31 Oct. 1989
Ian F. Akyildiz 31 Oct. 1989 7 p
(Grant AF-AFOSR-0028-88; AF Proj. 2304)
(AD-A221547; AFOSR-90-0464TR) Avail: NTIS HC A02/MF A01 CSCL 12/7

Performance has been a major issue in the design and implementation of systems such as: computer systems, production systems, communication networks and flexible manufacturing systems. The success of failure of such systems is judged by the degree to which performance objectives are met. Thus, tools and techniques for predicting performance measures are of great interest. In the last two decades it has been demonstrated several times that performance can be evaluated and/or predicted well by queuing models which can be solved either by simulation or analytical methods. Simulation is the most general and powerful technique for studying and predicting system performance. However, the high cost of running the simulation programs and uncertain statistical accuracy, makes simulation less attractive. Compared to simulation, analytical methods are more restrictive but have the advantage that it is less costly to compute numerical results. Moreover, they can be implemented very quickly, thus it is very easy to give interpretations to the relationships between model parameters and performance measures. Analytical methods have proved invaluable in modeling a variety of computer systems, computer networks, flexible manufacturing systems, etc. GRA

N90-27426# Texas Univ., Austin.
PROCEEDINGS OF WORKSHOP ON RELIABILITY IN COMPUTATIONAL MECHANICS
J. T. Oden, ed. 28 Oct. 1989 531 p Workshop held in Austin, TX, 26-28 Oct. 1989 Submitted for publication
(Contract N00014-89-J-1772)
(AD-A221694) Avail: NTIS HC A23/MF A03 CSCL 12/4

Much of what engineers and scientists do is to model natural phenomena. Mathematical models of nature are developed to study and predict the behavior of physical systems. The remarkable advances in technology over the last half century attest to the success of this approach. Mathematical models do indeed work. Their use represents a proven approach toward scientific discovery and engineering analyses and design, and one can safely predict that the confidence in results of mathematical modeling will grow as further proof and experience accumulates as to their utility and their reliability. Indeed, it is this latter quality, reliability, that emerges as the key to further progress in computational mechanics. There has been growing concern about the issue of reliability in computational modeling in recent years. The papers presented at the Workshop fell into four broad categories: mathematical modeling; a-priori analysis, including principles of convergence, robustness and their reliability; a-posteriori analysis, including adaptive methods; and computer aspects of modeling such as mesh generation, solid modeling and their reliability. In addition, papers on parallel computing, applications to practical problems, selection of benchmark problems for code verification, and related issues were discussed. GRA

N90-27427# Wright Research Development Center, Wright-Patterson AFB, OH.
PROVING BOOLEAN EQUIVALENCE WITH PROLOG Final Report, Jan. 1989 - Feb. 1990
Michael Alan Dukes and Frank Markham Brown Feb. 1990 22 p

(AF Proj. 6096)
(AD-A221766; WRDC-TR-90-5066; WRDC-TR-90-5006) Avail: NTIS HC A03/MF A01 CSCL 12/5

This report explains a Prolog program that performs Boole's Expansion Theorem. The Prolog program proves equivalence of Boolean formulas using the f = g form. The pattern matching feature of Prolog increases the efficiency of the proof process in some cases by avoiding expansion on every term of f and g. A proof of the Prolog program's correctness is also offered. The operators used within the confines of the algorithm are complement, conjunction, disjunction, and exclusive or. Some examples are presented to demonstrate the efficiency of the Prolog program. GRA

N90-27428# Yale Univ., New Haven, CT. Dept. of Electrical Engineering.
DEVELOPMENT AND ANALYSIS OF ARMA PARAMETER ESTIMATION SCHEMES IN THE PRESENCE OF NOISE Final Report, 1 Nov. 1987 - 31 Jan. 1990
Arye Nehorai 31 Jan. 1990 10 p
(Grant AF-AFOSR-0080-88; AF Proj. 2304)
(AD-A221794; AFOSR-90-0485TR) Avail: NTIS HC A02/MF A01 CSCL 12/3

The proposal focused on single-sensor parameter estimation for ARMA signals in noise. Several open problems in this area were solved and sine wave noise was added. Sensor array estimation algorithms for localization (tracking applications) were studied. The music estimator was developed and compared to the maximum likelihood estimator. Closed form expressions for the Cramer-Rao bound were discovered for certain cases of significance. Updating of the roots of an nth order polynomial in O(u-sq) time, and numerous applications are provided. GRA

N90-27429# Grenoble-1 Univ. (France). Techniques de l'Informatique, des Mathematiques, de la Microelectronique et de la Microscopie Quanti
GENERALIZED VORONOI DIAGRAMS: INITIAL RESULTS [DIAGRAMMES DE VORONOI GENERALISES: PREMIERS RESULTATS]
Hai-Tao Hu and Jean-Marc Chassery Dec. 1989 42 p In FRENCH
(IMAG-RR-799-M; ETN-90-97232) Avail: NTIS HC A03/MF A01

Work involved in building generalized Voronoi diagrams from polygonal objects is presented. Partitioning of Voronoi from the inside of a polygonal domain and its algorithmic implantation are discussed. The combination of the two diagrams gives the entire Voronoi diagram for all polygonal objects. Diagrams illustrating the bisecting and separating factors involved in the calculations are shown. The SEPMPEX algorithm used in solving such problems is presented. ESA

65 STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

N90-27430# Washington Univ., Seattle. Dept. of Statistics.
MODEL-BASED GAUSSIAN AND NON-GAUSSIAN CLUSTERING Technical Report, 1 May 1988 - 30 Sep. 1990
Jeffrey D. Banfield (Montana Univ., Missoula.) and Adrian E. Raftery Dec. 1989 34 p
(Contracts N00014-88-K-0265; N00014-89-J-1114)
(AD-A222097; TR-186) Avail: NTIS HC A03/MF A01 CSCL 12/3

The classification maximum likelihood approach is sufficiently general to encompass many current clustering algorithms, including those based on the sum of squares criterion and on the criterion of Friedman and Rubin (1967). However, as currently implemented, it does not allow the specification of which features (orientation, size and shape) are to be common to all clusters and which may differ between clusters. Also, it is restricted to Gaussian distributions and it does not allow for noise. Ways are proposed for overcoming these limitations. A reparameterization of the covariance matrix allows specification that some features, but not all, be the same for all clusters. A practical framework for non-Gaussian clustering is outlined, and a means of incorporating noise in the form of a Poisson process is described. An approximate Bayesian method for choosing the number of clusters is given. The performance of the proposed methods is studied by simulation, with encouraging results. The methods are applied to the analysis of a data set arising in the study of diabetes, and the results seem better than those of previous analyses. GRA

N90-27431# Rice Univ., Houston, TX. Dept. of Computer Science.
CAUSAL DISTRIBUTED BREAKPOINTS
Jerry Fowler and Willy Zwaenepoel May 1990 8 p Presented at the 10th International Conference on Distributed Computing Systems, May 1990 Submitted for publication
(Contract N00014-88-K-0140; NSF CCR-87-16914; NSF CDA-86-19893)
(AD-A222103) Avail: NTIS HC A02/MF A01 CSCL 12/3

A causal distributed breakpoint is initiated by a sequential breakpoint in one process of a distributed computation, and restores each process in the computation to its earliest state that reflects all events that happened before the breakpoint. A casual distributed breakpoint is the natural extension for distributed programs of the conventional notion of a breakpoint in a sequential program. An algorithm is presented for finding the causal distributed breakpoint given a sequential breakpoint in one of the processes. Approximately consistent checkpoint sets are used for efficiently restoring each process to its state in a causal distributed breakpoint. Causal distributed breakpoints assume deterministic processes that communicate solely by messages. The dependencies that arise from communication between processes are logged. Dependency logging and approximately consistent checkpoints sets have been implemented on a network of SUN workstations running the V-System. Overhead on the message passing primitives varies between 1 and 14 percent for dependency logging. Execution time overhead for a 200 x 200 Gaussian elimination is less that 4 percent, and generates a dependency log of 288 kilobytes. GRA

N90-27432# Alberta Univ., Edmonton. Dept. of Statistics and Applied Probability.
THE EXISTENCE OF SMOOTH DENSITIES FOR THE PREDICTION FILTERING AND SMOOTHING PROBLEMS
Robert J. Elliott and Michael Kohlmann (Konstanz Univ., Germany, F.R.) 1989 19 p Repr. from Acta Applicandae Mathematicae, v. 14, 1989 p 269-286 Revised Sponsored in part by European Office of Aerospace Research and Development, London, England
(Grant AF-AFOSR-0332-86; AF Proj. 2304)
(AD-A222108; AFOSR-90-0596TR) Avail: NTIS HC A03/MF A01 CSCL 12/3

Using a simple martingale representation result, a partial integration-by-parts formula is obtained. Quoting the results of Bismut and Michel, it then follows that under Hoermander's conditions on the coefficient vector fields, the filtering, smoothing and prediction problems have C at infinity density solutions. The development of an analysis over Wiener space is not required. GRA

N90-27433# Boston Univ., MA.
STATISTICAL METHODOLOGIES FOR NON-GAUSSIAN NOISY ENVIRONMENTS Final Report, 1 Nov. 1988 - 30 Apr. 1990
Murad S. Taqqu 9 May 1990 12 p
(Grant AF-AFOSR-0115-89; AF Proj. 2304)
(AD-A222137; AFOSR-90-0634TR) Avail: NTIS HC A03/MF A01 CSCL 12/3

The research focused on long range dependence, high variability and non-linear filtering in time series. Long range dependence occurs when the low frequencies have a fundamental impact on the dependence structure of the data. There is high variability when the data is non-Gaussian and takes large values

with high probability, for example when it is Pareto or has a stable distribution. The data can also be the output of a non-linear filter and hence possess non-linear characteristics. The behavior was studied of symmetric statistics, e.g., U and Von Mises statistics, and the asymptotoc behavior of quadratic forms, when the data has finite variance with long range dependence. The results are non-standard. Situations were studied where the data has a stable distribution and hence exhibits high variability. Joint moments, conditional moments, and linear regression problems were also studied. Linear Fractional Levy Motions are important models when the data exhibit both high variability and long range dependence. It was found that there are many such models and their asymptotic dependence structure was investigated. The tail behavior of probability distributions of multiple integrals was studied with respect to stable noise and the sample paths behavior of related stochastic processes. A technique was developed for approximating both the information structure and the paths behavior of stochastic processes. GRA

N90-27434# Florida State Univ., Tallahassee. Dept. of Statistics.
A HYPOTHESIS TEST OF CUMULATIVE SUMS OF MULTINOMIAL PARAMETERS
J. H. Clair and D. A. Meeter Feb. 1990 39 p
(Grant AF-AFOSR-0040-88; AF Proj. 2304)
(AD-A221466; TR-90-247; AFOSR-90-0426TR) Avail: NTIS HC A03/MF A01 CSCL 12/3

The Air Force is considering the contract renewal application of a civilian contractor hired to maintain in working order a series of radar stations. The measure of performance of interest is T, the time that a particular station is not on line while being down for repair. The contract stipulates that repair service will be such that on the average 50 percent of all repairs will be completed before L sub 1 hours and 90 percent of all repairs shall be completed before L sub 2 hours. It also states that the repair contract will be renewed on the basis of a decision rule that errs by failing to renew when the case is that the contract should be renewed with a probability of alpha. The renewal of the contract depends on the making a decision based on N repair times, T sub 1, T sub 2, ..., T sub N, of the contractor as to whether or not L sub 1 is at least the 50 to the th power percentile and L sub 2 is at least the 90 to the th power percentile of F(.), the distribution function F(.) of these repair times. The usual test based on the binomial distributions of the number of repairs before L sub 1 and the number of repairs before L sub 2 suffers from two problems: its true size is at times far from the nominal size; and because of the discrete of the random variables, cannot be performed at the stipulated size. The use is proposed of the likelihood ratio test based on the nultinomial joint distribution of the number of repairs before L sub 1 and the number of repairs before L sub 2. GRA

N90-27435# Wisconsin Univ., Madison. Dept. of Statistics.
MULTIVARIATE MODEL BUILDING AND MODEL IDENTIFICATION Final Report, 1 Apr. 1987 - 31 Dec. 1989
Grace Wahba 8 Apr. 1990 4 p
(Grants AF-AFOSR-0171-87; AF-AFOSR-0103-90; AF Proj. 2304)
(AD-A221619; AFOSR-90-0427TR) Avail: NTIS HC A01/MF A01 CSCL 12/3

A very substantial number of results were obtained in the area of multivariate model building and model identification. A list of publications in which the Air Force Contract is mentioned is given. The research monograph Spline Models for Observational Data by the PI was published. Although the actual writing of this monograph was not supported by the AFOSR, a number of research results obtained under AFOSR sponsorship are discussed in it. We have acknowledged in the Foreword the research support of the AFOSR. GRA

N90-27436# Universitaet der Bundeswehr Muenchen, Neubiberg (Germany, F.R.). Forschungsschwerpunkt Simulation und Optimierung deterministischer und stochastischer dynamischer Sy
COMPUTATION OF EFFICIENT SOLUTIONS OF DISCRETELY DISTRIBUTED STOCHASTIC OPTIMIZATION PROBLEMS
K. Marti Nov. 1989 66 p
(ETN-90-97330) Avail: NTIS HC A04/MF A01

The formulation and computation of stochastic optimization problems are studied. The obtaining of the loss function u is discussed. A basic definition of efficient solution is given. The construction of a set of efficient solutions for discretely distributed stochastic problems is analyzed. A system of linear relations for the construction of descent directions is presented. Examples of regression and curve fitting problems, statistical linearization, regression of the population, air quality planning problems, and scenario analysis is given. ESA

66 SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research.

N90-27437# Science Applications International Corp., McLean, VA.
DEPARTMENT OF ENERGY STRATEGIC DEFENSE INITIATIVE PROGRAMS: POTENTIAL PROGRAMMATIC AND FACILITY IMPACTS DUE TO A PROSPECTIVE DEFENSE AND SPACE TREATY
David E. Hoppler 10 May 1990 35 p
(Contract DE-AC01-88DP-50066)
(DE90-012717; DOE/DP-50066/T6) Avail: NTIS HC A03/MF A01

The objective of the following paper is to provide the DOE an analysis of the potential, but reasonably expected, impacts on DOE SDI-related programs resulting from alternative Defense and Space Treaty/Protocol outcomes. DOE facility impacts due to the implementation of Predictability and Confidence-Building Measures currently under negotiation will also be examined. DOE

N90-27438# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France). Avionics Panel.
TACTICAL APPLICATIONS OF SPACE SYSTEMS
May 1990 150 p Symposium held in Colorado Springs, CO, 16-19 Oct. 1989
(AGARD-CP-460; ISBN-92-835-0553-0) Copyright Avail: NTIS HC A07/MF A01; Non-NATO Nationals requests available only from AGARD/Scientific Publications Executive

The benefits, indeed the necessity of space systems to military operations have increased considerably in the past few years. Military communications satellites have demonstrated their effectiveness as elements of military command and control systems. The various weather satellites are providing more accurate and timely weather forecasting and have become important to all military operations. The 18 satellite-Global Positioning System may revolutionize weapon systems navigation guidance over the next decade. New remote sensing systems such as the Space Based Radar and other systems are in study on various stages of development. While the importance of space systems is becoming better appreciated, the full potential has not been realized. The intent was to bring into focus and to characterize the attributes which contribute to the effectiveness of tactical military operations. For individual titles, see N90-27439 through N90-27454.

N90-27439# Air Force Systems Command, Norton AFB, CA. Defense Meteorological Satellite Program.
TACTICAL APPLICATIONS OF DEFENSE METEOROLOGICAL SATELLITE PROGRAM (DMSP) ENVIRONMENTAL DATA
Juri Randmaa *In* AGARD, Tactical Applications of Space Systems May 1990 9 p (For primary document see N90-27438 21-66) Copyright Avail: NTIS HC A07/MF A01; Non-NATO Nationals

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Timely knowledge of weather conditions through the use of meteorological satellites is one of the major force multipliers for the United States and NATO countries. How the Defense Meteorological Satellite Program meets this need for timely data will be described. The Defense Meteorological Satellite Program (DMSP) has for over fifteen years supplied tactical meteorological data to Air Force, Navy, and Army units. This fully operational system consists of at least two satellites, a command and control system, a strategic data processing system, and tactical processing systems. Specifically, the DMSP mission is to provide global visible and infrared cloud data and other specialized meteorological, oceanographic, and solar-geophysical data in support of worldwide DOD operations. Environmental data is acquired by various sensors aboard the DMSP satellites in two modes. In the first mode, the data are stored on board for relay to the strategic centers at the Air Force Global Weather Central and at the Navy Fleet Numerical Oceanography Center. The second mode is the real-time direct broadcast of the environmental data to the land and sea-based tactical processing systems. All the environmental data are combined into one data stream and are broadcast in an encrypted mode on S band frequencies. The primary sensor carried on each satellite is the Operational Linescan System (OLS), which provides global cloud imagery in the visible and infrared bands. This data can be sent to the tactical user with a resolution of .6 km in one channel and 2.8 km is the other channel. This data are normally displayed in real time as the data from the sensor are taken. In the future, a variety of secondary mission sensors will be used to provide a complementary quantitative measure of the environment. Author

N90-27440# Air Force Systems Command, Norton AFB, CA. Air Weather Service.

APPLICATION OF METEOROLOGICAL SATELLITE (METSAT) DATA TO SUPPORT UNITED STATES FORCES IN THE NORTH ATLANTIC TREATY ORGANIZATION (NATO)

Alan L. Adams *In* AGARD, Tactical Applications of Space Systems May 1990 5 p (For primary document see N90-27438 21-66)

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Meteorological satellites play an important role in observing the environment and predicting how the environment will change with time. Such knowledge is absolutely crucial to military operations whose success or failure can often be directly influenced by changing environmental conditions. United States forces in NATO receive METSAT data from several sources and routinely use these data for operational decision making. The types of data available and the application of these data to United States Air Force and Army tactical military operations in NATO is discussed. Author

N90-27441# Aerospace Corp., Los Angeles, CA.

DMSP'S INTERACTIVE TACTICAL TERMINAL c47

Neal K. Baker *In* AGARD, Tactical Applications of Space Systems May 1990 4 p (For primary document see N90-27438 21-66)

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The Defense Meteorological Satellite Program (DMSP) is in the process of developing an interactive weather terminal as a functional replacement for their older tactical terminals. These new terminals will have fifty times the computer capability of the older Mark 4. This increase in computer capability allowed flexibility in developing system concepts. Four basic concepts were developed. The first was a build and apply concept for the operation of the system. In this concept, local data bases would be developed using the primary DMSP and NOAA sensors along with the microwave sensors. In addition, depending on the site location, various geosynchronous satellites would also be observed with that information added to the data base. The forecaster then would utilize this initial data base and build products. Another basic system concept was the quality control of the weather products. Quality control of the local data base environment was especially necessary because of immature sensor algorithms. Many functions were added for the purpose of quality control. In addition, since the forecaster is very busy with other tasks, the third system concept was to have a system which would collect data automatically and yet rapidly respond to the user when needed. The final system concept was graceful degradation, i.e., the ability to work with data dropouts, lack of individual sensor data, and other normal failures and yet still produce products. The hardware design incorporates redundancy to meet a high availability requirement and yet keep the corrective maintenance actions to a minimum. Corrective maintenance actions are to be done under a variety of conditions. In addition, a large number of built in test functions allows rapid analysis of failure modes. The combination of graceful degradation and the high availability requirements will produce a system that will work under tactical conditions. Author

N90-27442# Naval Observatory, Washington, DC. Office of the Oceanographer of the Navy.

TACTICAL OCEANOGRAPHY FROM SPACE: THE NEXT DECADE c48

Jonathan T. Malay *In* AGARD, Tactical Applications of Space Systems May 1990 5 p (For primary document see N90-27438 21-66)

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Naval Oceanography from space is a tactical force multiplier. Space systems are playing an ever increasing role in command, control and communications; surveillance and targeting; navigation; and environmental remote sensing. Oceanographic and meteorological satellites are supporting the fleet today and will be even more important in the next decade. Tactical oceanography from space is briefly described and current plans to participate in space technology development is briefly discussed. Author

N90-27443# Air Force Systems Command, Norton AFB, CA.

BLOCK 6: THE FUTURE DMSP SPACE SYSTEMS

Raymond G. Bonesteele and Rusty O. Baldwin *In* AGARD, Tactical Applications of Space Systems May 1990 5 p (For primary document see N90-27438 21-66)

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The acquisition strategy and anticipated capabilities of the Defense Meteorological Satellite Program (DMSP) Block 6 satellite system are described. It includes brief discussions of previous satellites and the requirements which drove the Block 6 system acquisition. The first three phases of acquisition are discussed: concept study, risk reduction, and full scale development. Strategy and concept of each phase are described in detail. The use of total quality management in each phase is discussed. Author

N90-27444# Air Force Systems Command, Norton AFB, CA. Space Systems Div.

SPACE-BASED WIDE AREA SURVEILLANCE SYSTEM STUDIES

Charles E. Heimach and Chester L. Whitehair (Aerospace Corp., El Segundo, CA.) *In* AGARD, Tactical Applications of Space Systems May 1990 12 p (For primary document see N90-27438 21-66)

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The U.S. Department of Defense (DoD) is vigorously exploring and evaluating alternative concepts for conducting global wide area surveillance using space-based assets. The objective is to provide for the detection, identification, and tracking of atmospheric, ocean surface and ground targets on a 24-hour basis, worldwide and under all weather conditions. Candidate concepts include radar systems, infrared systems, and a combination of both. The current effort is based on a series of engineering concept studies and

designs. The primary evaluation tool is an in-depth computer simulation that is being used to model each concept in a simulated operational environment. This simulation is described with several example operational missions and alternative space-based surveillance systems. The U.S. Department of Defense (DoD) is conducting Cost and Operational Effectiveness Analyses (COEA) of the Space-Based Wide Area Surveillance System (SBWASS) concepts in preparation for a decision to start the demonstration/validation phase. The principal goal of the COEA effort is to develop detailed information about the ability of space-based systems to satisfy surveillance needs of operational forces beyond the range of existing sensors in an afforable, cost-effective manner. The SBWASS will provide global, all-weather, day/night, near-real-time tactical and strategic warning of air and surface attacks directly to operational forces. Author

N90-27445# MacDonald, Dettwiler and Associates Ltd., Richmond (British Columbia).
COMMAND AND CONTROL IN THE AGE OF SPACE-BASED SURVEILLANCE
Murray MacDonald *In* AGARD, Tactical Applications of Space Systems May 1990 5 p (For primary document see N90-27438 21-66)
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The Canadian and United States defense departments are currently investigating requirements and technologies appropriate to a constellation of radar satellites providing global surveillance against targets such as cruise missiles, long-range bombers, strategic fighters, and surface ships. Command and Control of Canadian forces using data obtained from this space-based radar (SBR) satellite system will pose an intricate set of problems, complicated by data transfer requirements and the potential number of agencies involved with different aspects of SBR operations. Since extensive on board processing is unlikely during the early years of SBR, data will need to be downlinked to a central facility, processed, and distributed to appropriate regional stations. Operational tasking requirements from regional stations will have to be coordinated by the central control station and uplinked to the satellite. All of these processes will need to be carried out within the real-time constraints of a surveillance operation. Data transfer and processing constraints are discussed in the context of the command and control issues that will arise with the advent of SBR. Author

N90-27446# Air Force Systems Command, Norton AFB, CA.
GLOBAL POSITIONING SYSTEM OVERVIEW/STATUS c04
M. T. Runkle and B. Siegel (Aerospace Corp., Los Angeles, CA.) *In* AGARD, Tactical Applications of Space Systems May 1990 7 p (For primary document see N90-27438 21-66)
Copyright Avail: NTIS HC A07/MF A01; Non-NATO Nationals requests available only from AGARD/Scientific Publications Executive

The Global Positioning System (GPS) program status is summarized and a review of the system concept and several applications are provided. Author

N90-27447# Air Force Systems Command, Eglin AFB, FL. Munitions Systems Div.
FUTURE APPLICATIONS OF GPS TO CONVENTIONAL WEAPONS c04
Stephen M. McElroy and Louis R. Cerrato *In* AGARD, Tactical Applications of Space Systems May 1990 13 p (For primary document see N90-27438 21-66)
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The potential role of Global Positioning System (GPS) in future conventional weapon applications are discussed. Short range weapons can benefit from accurate GPS initialization, while medium and long range standoff weapons could incorporate GPS in their navigation systems. The problem of jamming and design techniques to improve the capabilities of GPS will be discussed. Several important integration issues will also be highlighted. Author

N90-27448# Army Avionics Lab., Fort Monmouth, NJ.
HOVER POSITION SENSING SYSTEM c06
Stephen P. Ahrens and Joseph McGowan (Intermetrics, Inc., Oceanport, NJ.) *In* AGARD, Tactical Applications of Space Systems May 1990 8 p (For primary document see N90-27438 21-66)
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The U.S. Army Light Helicopter Experimental (LHX) aircraft has a requirement for a Hover Hold System with a desired accuracy of 1 meter RMS for a 3 minute period. AVRADA (Avionics Research and Development Activity) recently completed a demonstration program which indicated that an error of 0.6 meter or less is achievable with the LHX navigation sensor suite. The demonstration program and results are presented. Author

N90-27449# Aerospace Corp., Los Angeles, CA.
POTENTIAL NEW TACTICAL APPLICATIONS OF THE GLOBAL POSITIONING SYSTEM (GPS) c04
Mohan P. Ananda and John E. Clark *In* AGARD, Tactical Applications of Space Systems May 1990 9 p (For primary document see N90-27438 21-66)
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The Global Positioning System (GPS) is an all weather global navigation satellite system deployed by the United States Department of Defense primarily for achieving force enhancements for the United States and NATO military forces. The major objective of the GPS is to provide highly accurate positioning capability to tactical weapon platforms. The GPS will eventually have 21 to 24 operational satellites continuously transmitting navigation signals to users around the globe. Possibilities of using GPS to disseminate critical information in time of conflict to tactical forces are investigated. This type of information distribution can be accomplished without any space vehicle hardware modifications on the GPS Block 2 vehicles by the use of spare bits in the navigation message data frames. With minimum hardware changes on the next generation GPS Block 2R space vehicles, a continuous communication channel can be made available. Various system engineering issues and applications related to the communication capability of GPS are provided. Author

N90-27450# Aerospace Corp., Los Angeles, CA.
TACTICAL USES OF THE DSCS 3 COMMUNICATIONS SYSTEM
A. T. Finney *In* AGARD, Tactical Applications of Space Systems May 1990 7 p (For primary document see N90-27438 21-66)
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Originally conceived and designed in the late 1970's, the DSCS 3 Communications System was primarily oriented toward long haul, point-to-point service for strategic users who desired a high degree of antijam capability combined with physical survivability. The satellite portion of the system was designed under the auspices of the United States Air Force Space Systems Division. Overall responsibility for the DSCS system rests with the Defense Communications Agency (DCA), which has developed much of the tactical philosophy discussed in subsequent paragraphs. Although primarily conceived as a strategic support system, a significant portion of the total resource was allocated to tactical uses. In subsequent paragraphs, some of the tactical concepts that evolved for the present design, as well as some new ideas concerning possible tactical uses for the system, will be described. Author

N90-27451# Naval Space Surveillance System, Dahlgren, VA.
TACTICAL APPLICATIONS OF THE UHF SATELLITE COMMUNICATIONS SYSTEM
Philip J. LaTulippe, William C. Clair, and Joseph L. K. Corcoran *In* AGARD, Tactical Applications of Space Systems May 1990 5 p (For primary document see N90-27438 21-66)
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Information on how the U.S. Navy uses the UHF Communications Satellite Systems to support its tactical operations is provided. It identifies shortfalls associated with the existing UHF SATCOM System and shows how these shortfalls are overcome. It presents methods which are used to operationally increase the number of satellite accesses available by implementing FDM and TDM techniques. New space communications initiatives are also discussed. Author

N90-27452# Defense Communications Agency, Washington, DC. Military Satellite Communications System Office.
THE POST-2000 MILSATCOM ARCHITECTURE c18
Robert L. Drummond and Gregory B. Frick *In* AGARD, Tactical Applications of Space Systems May 1990 7 p (For primary document see N90-27438 21-66)
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Military satellite communications (MILSATCOM) systems presently in use and those under development will provide service to a variety of users until the end of the 20th century. What MILSATCOM systems should be fielded for the post-2000 time frame is the subject of an intense study called The Alternative MILSATCOM Architectures (TAMA). The present MILSATCOM architecture, including those systems scheduled to begin operation in the early 1990's are examined; how the TAMA study was conducted is discussed; and insights are presented as to what the 2010 MILSATCOM Architecture should look like. Author

N90-27453# Massachusetts Inst. of Tech., Lexington. Lincoln Lab.
LIGHTWEIGHT EHF COMMUNICATIONS SATELLITES c18
David R. McElroy, Dean P. Kolba, and Marilyn D. Semprucci *In* AGARD, Tactical Applications of Space Systems May 1990 10 p (For primary document see N90-27438 21-66)
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Current and planned Military Satellite Communications (MILSATCOM) systems, which typically employ a few, large satellites operating in synchronous altitude circular orbits, provide good fundamental service. However, there are concerns among some users regarding the potential for localized capacity shortfalls, particularly for anti-jam tactical service. Due to the large size of the currently planned satellites, there is no capability to rapidly augment capacity through timely and survivable launches of additional space assets. Small EHF satellites can significantly complement the anti-jam service of basic MILSATCOM space segments. Mobile/survivable launch vehicles with rapid launch preparations can be utilized to deploy these satellites into high altitude elliptical or circular orbits. In these orbits, only a few satellites are needed for high duty cycle coverage of critical areas. Through the use of standard EHF waveforms, the complementary satellites will be compatible with existing EHF terminals. Advanced technology allows the development of the highly capable, lightweight payloads required for this role. Some of the key technologies for these complementary satellites include high speed, low power digital processing subsystems, lightweight frequency hopping synthesizers, and efficient solid-state transmitters. These same technologies are also applicable in reducing the size of the large, fundamental-service space segments or in implementing highly capable secondary EHF payloads. Author

N90-27454# Microtel Pacific Research Ltd., Burnaby (British Columbia).
TACTICAL EHF SATELLITE COMMUNICATIONS FOR NATO EMPLOYING NON-GEOSTATIONARY ORBITS c32
M. Jamil Ahmed *In* AGARD, Tactical Applications of Space Systems May 1990 17 p (For primary document see N90-27438 21-66)
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Most of the world's satellite communications employ satellites in the geostationary orbit, for ease of tracking by the ground stations, and the ability to realize coverage of the populated regions of the globe with a set of three satellites. Geostationary satellites, however, afford poor visibility and degraded performance in the northern zones. This area is extensive and it is of strategic military importance. Satellites in the non-geostationary orbits can provide the required coverage in the north. The use of non-geostationary satellites is examined for tactical communication for NATO, their orbits, and implications for on-board processing. Author

N90-27455# Rice Univ., Houston, TX. Dept. of Computer Science.
TRANSPARENT OPTIMISTIC ROLLBACK RECOVERY
David B. Johnson and Willy Zwaenepoel Apr. 1990 4 p Presented at the European SigOps Workshop on Fault Tolerance, Oct. 1990
(Contract N00014-88-K-0140; NSF CCR-87-16914; NSF CDA-86-19893)
(AD-A222102) Avail: NTIS HC A01/MF A01 CSCL 12/4

The following questions are asked: What are appropriate paradigms for supporting fault-tolerant applications and how can they be implemented efficiently? To what extent can fault tolerance be retrofitted into existing applications automatically? What lessons can be learned from existing implementations of fault-tolerant and distributed systems? GRA

N90-27456# Army War Coll., Carlisle Barracks, PA.
STRATEGIC DEFENSE INITIATIVE: THREE REASONS TO STAY THE COURSE Individual Study Project
Hans J. Bleeker 12 Feb. 1990 32 p
(AD-A222246) Avail: NTIS HC A03/MF A01 CSCL 15/3

President Reagan's Strategic Defense Initiative has had a profound effect on the shape the world has taken since that time. While there has been much talk that the system as envisioned by the president is impossible, three compelling reasons why the research and development effort should be continued are examined. The Strategic Defense Initiative has brought the Soviets to the bargaining table and made CFE a reality. The threat of nuclear and chemical proliferation makes the deployment of a defensive system a logical strategy. The cost of developing and deploying the Strategic Defense Initiative may not be as high as the critics propose if SDI can be used as the third leg of the strategic deterrent. GRA

N90-27457# Stanford Univ., CA. Systems Optimization Lab.
NEWTON METHODS FOR LARGE-SCALE LINEAR EQUALITY-CONSTRAINED MINIMIZATION
Anders L. Forsgren and Walter Murray Apr. 1990 34 p Sponsored in part by Goeran Gustafsson Foundation and National Board for Technical Development, Sweden
(Contract N00014-90-J-1242; NSF DDM-87-15153)
(AD-A222310; SU-SOL-90-6) Avail: NTIS HC A03/MF A01 CSCL 12/4

Newton methods for large scale minimization subject to linear equality constraints are discussed. For large scale problems, it may be prohibitively expensive to reduce the problem to an unconstrained problem in the null space of the constraint matrix. Computational schemes are investigated that enable the computation of descent directions and directions of negative curvature without the need to know the null-space matrix. The schemes are based on factorizing a sparse symmetric indefinite

matrix. Three different methods are proposed for computing the desired directions. Convergence properties for the different methods are established. GRA

N90-27458# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Engineering Science and Mechanics.
NONLINEAR DYNAMICS AND CONTROL OF SDI STRUCTURAL COMPONENTS Final Report, Sep. 1987 - Feb. 1990
Ali H. Nayfeh, J. A. Burns, and E. M. Cliff 18 May 1990 16 p
(Contract F49620-87-C-0088)
(AD-A222472; AFOSR-90-0647TR) Avail: NTIS HC A03/MF A01 CSCL 15/3

Results are summarized of experimental and theoretical investigations into the nonlinear response and control of structural elements. Methods for the analysis and design of control procedures applicable to certain nonlinear distributed parameter systems were investigated. Analytical and computational techniques were developed for evaluating the nonlinear effects on control designs. Bench-type experiments were conducted for validating some of the theoretical results. GRA

67 THEORETICAL MATHEMATICS

Includes topology and number theory.

N90-27459# Air Force Inst. of Tech., Wright-Patterson AFB, OH. School of Engineering.
INTEGRATED STRUCTURAL/CONTROL DESIGN VIA MULTIOBJECTIVE OPTIMIZATION Ph.D. Thesis
Garret L. Schneider May 1990 88 p
(AD-A223088; AFIT/DS/ENY/90-02) Avail: NTIS HC A05/MF A01 CSCL 12/2

A minimum correction homotopy approach is used to obtain the simultaneous/integrated optimal design of a large flexible structure and its active control system. Instead of the usual method of weighting and summing all desired objectives to form a constrained scalar optimization problem, a vector of objective functions is dealt with directly. The Draper/RPL configuration (a central hub with four symmetric, identical arms) is the design structure. The design seeks to minimize the mass of the arms. Using simple feedback of arm displacements and velocities, the control system seeks to achieve specified closed-loop eigenvalues (frequencies and damping ratios) and control effort. Design variables are the arm dimensions, control system gains, and sensor and actuator locations. Not only can the structural design be accomplished while placing the closed-loop eigenvalues, but a simultaneous 50 percent reduction in mass and/or control effort can be obtained. Since reduced-order models were used for the structural/control design, the resultant configurations are easily driven unstable by spillover from higher-order unmodeled modes. A modal suppression technique is applied to eliminate observation spillover and provide a decade of deadband above the controller bandwidth. GRA

70 PHYSICS (GENERAL)

For precision time and time interval (PTTI) see *35 Instrumentation and Photography;* for geophysics, astrophysics or solar physics see *46 Geophysics, 90 Astrophysics,* or *92 Solar Physics.*

N90-27460# Massachusetts Inst. of Tech., Cambridge. Dept. of Physics.
VELOCITY SELECTION TO ENABLE DIRECT MEASUREMENT OF STRONG SINGLE ATOM-OPTICAL CAVITY COUPLING Final Report M.S. Thesis
Michael E. Donovan Jun. 1990 90 p
(AD-A223060) Avail: NTIS HC A05/MF A01 CSCL 20/5

Whether a velocity selector can sufficiently reduce Doppler broadening of a concentric optical cavity coupled to single atoms in an atomic beam so that the normal mode splitting can be observed is examined. A simplified model of the atom-cavity system as undamped coupler oscillators is used to derive the coupling strength. The theory of velocity selectors is reviewed and a density reduction formula is derived and studied. Considerations for building a velocity selector for an atom-cavity experiment are examined. A tentative inclusion of cavity Doppler broadening in a semi-classical theory is presented. Experiments are presented which show good agreement to theory for density reduction at high velocity selector speeds and an additional density loss of 50 percent when selecting atoms less than 20 percent of thermal velocity. Data shows both effusive and supersonic beams. GRA

N90-27461# Cornell Univ., Ithaca, NY. Dept. of Physics.
PHYSICS AND TECHNIQUES FOR THE INVESTIGATION OF THE PROPERTIES OF ULTRA SMALL SYSTEMS Final Report, 15 Jan. 1987 - 14 Jan. 1990
Jeevak M. Parpia and Robert C. Richardson 9 May 1990 25 p
(Grant AF-AFOSR-0148-87; AF Proj. 2306)
(AD-A221985; AFOSR-90-0641TR) Avail: NTIS HC A03/MF A01 CSCL 20/3

This program is directed toward the study of transport and non-equilibrium thermal effects in diverse miniaturized systems at low temperatures. The research fabricates and probes the behavior of materials without affecting their internal structure. The techniques extend our ability to characterize materials as well as to understand the effects of technology used in patterning and fabricating small devices. The techniques developed in this research should prove to be useful for the non-destructive evaluation of the properties of materials as well as for the design of miniaturized superconducting devices. GRA

N90-27462# Army Armament Research, Development and Engineering Center, Picatinny Arsenal, NJ. Product Assurance Directorate.
MAGNETIC FLUX LEAKAGE VERSUS ULTRASONIC CORRELATION Final Report
Syed Ali, Luis A. Torres, and George Zamloot May 1990 24 p
(AD-A222112; ARPAD-TR-90002) Avail: NTIS HC A03/MF A01 CSCL 20/3

Recent development in magnetic flux technology have made possible the creation of an inspection system that automatically detects and evaluates surface and subsurface defects in projectile bodies with high reliability and lower cost than competing measurement schemes. The device is capable of detecting the orientation. Operating automatically, the system can load, scan, unload, and segregate acceptable and defective parts without operator intervention. This report establishes the difference between this technique and the ultrasonic method which is currently used in production. GRA

N90-27463# Wisconsin Univ., Madison. Dept. of Physics.
RESEARCH ON OPTOGALVANIC EFFECTS Final Report, 30 Sep. 1984 - 30 Sep. 1989
J. E. Lawler 30 Dec. 1989 74 p
(Grant AF-AFOSR-0328-84; AF Proj. 2301)
(AD-A221512; AFOSR-90-0440TR) Avail: NTIS HC A04/MF A01 CSCL 20/3

Highly accurate elective field maps, gas density measurements, and a model of ion transport were combined to determine the current balance at the surface of a cold aluminum cathode. The ratio of ion to electron current was found to be 3.3 at the cathode surface. This ratio is independent of total discharge current from a near normal cathode fall of 173V to a highly abnormal cathode fall of 600V. GRA

N90-27179# Finnish Meteorological Inst., Helsinki. Dept. of Geophysics.
COIL SYSTEM FOR THE PRODUCTION OF THREE-COMPONENT UNIFORM MAGNETIC FIELD AT THE NURMIJARVI OBSERVATORY
L. Hakkinen, Jouni Ryno, and Christian Sucksdorff *In its* Proceedings of the International Workshop on Geomagnetic

Observatory Data Acquisition and Processing 15 Feb. 1990 p 17-22 (For primary document see N90-27177 21-46)
Avail: NTIS HC A07/MF A01

N90-27180# Finnish Meteorological Inst., Helsinki. Dept. of Geophysics.
MEASURING SENSITIVITIES AND ORTHOGONALITIES OF MAGNETOMETER SENSORS IN THE NURMIJARVI COIL HUT
L. Hakkinen and Jouni Ryno *In its* Proceedings of the International Workshop on Geomagnetic Observatory Data Acquisition and Processing 15 Feb. 1990 p 37-39 (For primary document see N90-27177 21-46)
Avail: NTIS HC A07/MF A01

N90-27182# Institut de Physique du Globe, Paris (France). Dept. de Geomagnetisme.
A NEW METHOD FOR THE ABSOLUTE MEASUREMENT OF GEOMAGNETISM BEGINNING WITH DI FLUX [NOUVELLE METHODOLOGIE POUR LES MESURES ABSOLUES MAGNETIQUES A PARTIR D'UN APPAREILLAGE D-I-FLUX]
D. Gilbert *In* Finnish Meteorological Inst., Proceedings of the International Workshop on Geomagnetic Observatory Data Acquisition and Processing 15 Feb. 1990 p 67-71 In FRENCH (For primary document see N90-27177 21-46)
Avail: NTIS HC A07/MF A01

71 ACOUSTICS

Includes sound generation, transmission and attenuation. For noise pollution see *45 Environmental Pollution.*

N90-27464*# Florida Atlantic Univ., Boca Raton. Center for Acoustics and Vibration.
INTERACTION OF ACOUSTIC WAVES GENERATED BY COUPLED PLATE Progress Report No. 1, Jan. - Jul. 1990
J. M. Cuschieri Jul. 1990 17 p
(Grant NAG1-1077)
(NASA-CR-186873; NAS 1.26:186873) Avail: NTIS HC A03/MF A01 CSCL 20A

When two substructures are coupled, the acoustic field generated by the motion of each of the substructures will interact with the motion of the other substructure. This would be the case of a structure enclosing an acoustic cavity. A technique to model the interaction of the generated sound fields from the two components of a coupled structure, and the influence of this interaction on the vibration of the structural components is presented. Using a mobility power flow approach, each element of the substructure is treated independently both when developing the structural response and when determining the acoustic field generated by this component. The presence of the other substructural components is introduced by assuming these components to be rigid baffles. The excitation of one of the substructures is assumed to be by an incident acoustic wave which is dependent of the motion of the substructure. The sound field generated by the motion of the substructure is included in the solution of the response. Author

N90-27465*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.
THE VALIDATION AND APPLICATION OF A ROTOR ACOUSTIC PREDICTION COMPUTER PROGRAM
Judith M. Gallman 1990 16 p
(NASA-TM-101794; NAS 1.15:101794; AD-A222725) Avail: NTIS HC A03/MF A01 CSCL 20/1

An essential prerequisite to reducing the acoustic detectability of military rotorcraft is a better understanding of main rotor noise which is the major contributor to the overall noise. A simple, yet accurate, Rotor Acoustic Prediction Program (RAPP) was developed to advance the understanding of main rotor noise. This prediction program uses the Ffowcs Williams and Hawkings (FW-H) equation. The particular form of the FW-H equation used is well suited for the coupling of the measured blade surface pressure to the prediction of acoustic pressure. The FW-H equation is an inhomogeneous wave equation that is valid in all space and governs acoustic pressure generated by thin moving bodies. The nonhomogeneous terms describe mass displacement due to surface motion and forces due to local surface stresses, such as viscous stress and pressure distribution on the surface. This paper examines two of the four types of main rotor noise: BVI noise and low-frequency noise. Blade-vortex interaction noise occurs when a tip vortex, previously shed by a rotor blade, passes close enough to a rotor blade to cause large variations in the blade surface pressures. This event is most disturbing when it happens on the advancing side of the rotor disk. Low-frequency noise includes hover and low to moderate speed forward flight. For these flight conditions, the low frequency components of the acoustic signal dominate. GRA

N90-27466# Aerospace Medical Research Labs., Wright-Patterson AFB, OH.
AIR FORCE PROCEDURE FOR PREDICTING AIRCRAFT NOISE AROUND AIRBASES: AIRBASE OPERATIONS PROGRAM (BASEOPS) DESCRIPTION Technical Report, Jul. 1988 - Jan. 1990
Robert A. Lee and Henry T. Mohlman Jan. 1990 82 p
(AF Proj. 7231)
(AD-A223069; AAMRL-TR-90-012) Avail: NTIS HC A05/MF A01 CSCL 20/1

A user manual is presented for the BASEOPS 3.00 program developed by AAMRL/BBE. The installation, use and limitations of this program is described. BASEOPS is the menu driven computerized airbase operations input program used in doing airbase noise assessments under the USAF Air Installation Compatible Use Zone (AICUZ) program. BASEOPS will create a file that can be directly interfaced to the NOISEMAP 6.0 program, used to calculate the total noise exposure from these input operations. BASEOPS contains default performance profiles (takeoff and landing) for Military Transient and Civil aircraft. The program also allows the user to create a NOISEMAP input file for any subset of the input data through a Global Editing Menu. This can be used for quickly creating multiple noise analyses for different operational input scenarios. GRA

N90-27467# Wyle Labs., Inc., El Segundo, CA.
AIR FORCE PROCEDURE FOR PREDICTING AIRCRAFT NOISE AROUND AIRBASES: NOISE EXPOSURE MODEL (NOISEMAP). USER'S MANUAL Final Report, Jul. 1988 - Jan. 1990
Carey L. Moulton Feb. 1990 138 p
(Contract F33615-89-C-0531; AF Proj. 7231)
(AD-A223162; AAMRL-TR-90-011) Avail: NTIS HC A07/MF A01 CSCL 20/1

This report describes the NOISEMAP 6.0 Noise Exposure Model and is intended as a user's guide for these programs. The report provides operating details on the MCM, OMEGA 10 and 11, and NMAP60 computer programs (which are all encompassed by the term NOISEMAP 6.0). The BASEOPS and NMPLOT programs are also discussed but only in relation to their interaction with NOISEMAP 6.0. Information regarding the changes made between NOISEMAP 6.0 and older versions are listed and a methodology for converting older NOISEMAP decks to this new version is discussed. The limitations of NOISEMAP 6.0 are detailed. An example case is provided for a small joint-use airfield. Three general aviation categories are employed (single, twin, and jet) and one military designation. Appendix C provides a complete listing of all the military and civilian aircraft which are contained in NOISEFILE 6.0 including power settings and airspeeds. GRA

N90-27468# Defence Research Establishment Atlantic, Dartmouth (Nova Scotia).
NOISE FROM TIP VORTEX AND BUBBLE CAVITATION
Neil C. Sponagle Mar. 1990 41 p
(AD-A221962; DREA-TM-90/202) Avail: NTIS HC A03/MF A01 CSCL 20/1

This paper presents results from experiments designed to study

the sound from different types of propeller cavitation. The propellers used in the tests produced tip vortex and travelling bubble cavitation. The spectral content, directivity, and waveform of the far-field sound were measured, in essentially free-field conditions up to 100 kHz. These data were then correlated with information about the cavity dynamics, obtained from visual observations. Vibrational modes on the tip vortex cavities produced sound at characteristic frequencies. Bubble cavitation by itself produced very broadband noise, and strongly affected the vortex cavitation noise mechanisms if the free bubbles entered the tip vortices. The noise from both kinds of cavitation was directional. GRA

N90-27469# Army Aviation Development Test Activity, Fort Rucker, AL. Human Factors Engineering Div.
AVIATION ACOUSTICAL NOISE MEASUREMENT Final Report
Ron Smith Feb. 1990 24 p
(AD-A222014; TECOM-7-CO-R89-AVO-004) Avail: NTIS HC A03/MF A01 CSCL 20/1

U.S. Army Aviation Development Test Activity investigated methodology for planning, collecting, analyzing, and reporting steady-state acoustical noise parameters of U.S. Army aviation systems. It was concluded that: Planning for development of future aviation systems should incorporate extensive acoustical analysis to minimize the negative impact of environmental noise on personnel. Acoustical analysis should be incorporated as early as possible during the development process so that appropriate corrective action can be initiated. Previous experience has demonstrated that system design which incorporates appropriate acoustical protection is less expensive to develop than noise reduction programs after the system is operational. It was recommended that a formal Test Operations Procedure (TOP) be developed which describes standardized procedures for planning, execution, collection, analysis, and reporting of steady-state acoustical noise parameters within current/future U.S. Army aviation systems. GRA

N90-27470# David Taylor Research Center, Bethesda, MD. Dept. of Propulsion and Auxiliary Systems.
TEMPORAL RESPONSE OF COUPLED ONE-DIMENSIONAL DYNAMIC SYSTEMS Research and Development Report
J. Dickey and G. Maidanik 6 Apr. 1990 37 p Submitted for publication
(AD-A222375; DTRC-90/012) Avail: NTIS HC A03/MF A01 CSCL 20/1

A formalism is presented which describes the response of a complex of coupled 1-D dynamic systems to an impulse drive. The formalism is based on an impulse response operator which relates a drive applied to one point in the complex to the response at any point in the complex. The formalism is derived directly in the time domain, and the impulsive drives which can be accommodated must be finite in time and applied at a spatial point. The constituent systems must be 1-D and possess a pulse propagation velocity which is not a function of position within the system. Systems interact through junctions which also define their spatial extents. The junctions are characterized by reflection and transmission coefficients which modulate the amplitude of reverberant components and by delays in the reflections and transmissions. Propagation in the systems is characterized by losses. Several simplistic examples are calculated and presented to illustrate the type of information which the formalism can provide. GRA

N90-27471*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
THE ACOUSTIC RESULTS OF A UNITED TECHNOLOGIES SCALE MODEL HELICOPTER ROTOR TESTED AT DNW
Sandy R. Liu (Army Aviation Systems Command, Moffett Field, CA.) and Michael A. Marcolini May 1990 20 p Presented at the 46th Annual Forum of the American Helicopter Society, Washington, DC, May 1990
(NASA-TM-101879; NAS 1.15:101879; AD-A222532) Avail: NTIS HC A03/MF A01 CSCL 20/1

In a major cooperative program between U.S. Government agencies (represented by the U.S. Army Aeroflightdynamics Directorate and NASA Ames and Langley Research Centers) and United Technologies Corp. A 1/6 geometrically and aeroelastically scaled UTC model helicopter rotor was tested in the open-jet anechoic test section of the Duits-Nederlandse Windtunnel in the Netherlands. As the fourth entry under the Aerodynamic and Acoustic Testing of Model Rotors Program, several comprehensive acoustic and aerodynamic databases were obtained relating the important aerodynamic phenomena to both the near- and far-field acoustic radiation. In particular, high speed impulsive noise and blade-vortex interaction are of primary interest. This paper provides an initial summary of the acoustic measurements acquired for some of the different configurations tested. A review of the baseline swept tip rotor acoustic characteristics in the regimes of high speed forward flight, where high speed impulsive noise dominates, and low speed descent, where severe blade vortex interaction noise occurs, is presented. The trends of these primary noise sources are studied as the first step in validating the data for release and application. GRA

72 ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure, electron properties, and molecular spectra.

N90-27472*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
SLOW POSITRON BEAM GENERATOR FOR LIFETIME STUDIES Patent Application
Jag J. Singh, inventor (to NASA), Abe Eftekhari, inventor (to NASA) (Analytical Services and Materials, Inc., Hampton, VA.), and Terry L. St.Clair, inventor (to NASA) 31 May 1990 21 p
(NASA-Case-LAR-14250-1-SB; NAS 1.71:LAR-14250-1-SB; US-Patent-Appl-SN-531372) Avail: NTIS HC A03/MF A01 CSCL 20H

A slow positron beam generator uses a conductive source residing between two test films. Moderator pieces are placed next to the test film on the opposite side of the conductive source. A voltage potential is applied between the moderator pieces and the conductive source. Incident energetic positrons are, first, emitted from the conductive source, second, passed through test film, and then, third, isotropically strike moderator pieces before diffusing out of the moderator pieces as slow positrons. The slow positrons diffusing out of moderator pieces are attracted to the conductive source which is held at an appropriate potential below the moderator pieces. The slow positrons have to pass through the test films before reaching the conductive source. A voltage is adjusted so that the potential difference between the moderator pieces and the conductive source forces the positrons to stop in the test films. Measurable annihilation radiation is emitted from the test film when positrons annihilate (combine) with electrons in the test film. NASA

N90-27473# SRI International Corp., Menlo Park, CA.
SUPPORT FOR THE FORTY-SECOND ANNUAL GASEOUS ELECTRONICS CONFERENCE Final Report, 1 Sep. 1989 - 31 Aug. 1990
D. L. Huestis 7 May 1990 222 p Conference held in Palo Alto, CA, 16-20 Oct. 1989 Sponsored in part by ARO; NSF; GE; and GTE Sylvania, Inc.
(Grant AF-AFOSR-0499-89; AF Proj. 2301)
(AD-A222881; AFOSR-90-0644TR) Avail: NTIS HC A10/MF A02 CSCL 20/9

Abstracts are presented of papers presented at this conference. Some of the areas of discussion for sessions are: Diagnostics of Processing Discharges, Hydrocarbon Plasmas, Kinetic Models, Electron Diffusion, Plasma Processing, Heavy Particle and Excited State Collisions, Workshop on the Reference System for RF Plasma Processing Research, Ionization, Laser Phenomena, Arcs and Glows, Electron and Heavy Particle Collisions, Ar/Xe Lasers I, Breakdown and Switching, Ar/Xe Lasers II, Cross Section Data I, Fundamental Data from Plasmas, Cross Section II, Novel Plasmas,

Cross Sections I Wish I Knew, Single Wafer Plasma Processing, Collisions Between Atoms, Molecules, and Ions, RF Discharges: Models and Experiments, and Optical Diagnostics. GRA

N90-27474# Virginia Univ., Charlottesville.
STRUCTURE AND DYNAMICS OF EXCITED ATOMS Final Report, 1 Nov. 1986 - 31 Oct. 1989
Thomas Francis Gallagher Mar. 1990 20 p
(Grant AF-AFOSR-0007-87; AF Proj. 2301)
(AD-A221973; AFOSR-90-0604TR) Avail: NTIS HC A03/MF A01 CSCL 20/8

We have studied processes in excited atoms driven by strong microwave radiation fields to gain a quantitative understanding of what are usually thought of as highly nonlinear processes. We have discovered that circularly polarized microwave fields produce ionization only at fields above 1/16n4, the much higher field required for static field ionization. We have also observed above threshold ionization at microwave frequencies and shown that in the microwave regime it is easily described by a classical theory, which ties together above threshold ionization at microwave frequencies and shown that in the microwave regime it is easily described by a classical theory, which ties together above threshold ionization and ponderomotive energy shifts. Finally, we have made significant progress toward observing collisions which begin and end under control. GRA

N90-27475# Air Force Geophysics Lab., Hanscom AFB, MA. Space Physics Div.
LABORATORY STUDY OF ION-NEUTRAL COLLISIONS AT SUPRATHERMAL ENERGIES Interim Report, Jan. 1988 - Dec. 1989
James A. Gardner, Rainer A. Dressler, Richard H. Salter, and Edmond Murad 28 Dec. 1989 49 p Sponsored by AFOSR, Bolling AFB, Washington, DC
(AF Proj. 2303)
(AD-A222117; GL-TR-89-0345) Avail: NTIS HC A03/MF A01 CSCL 20/5

A double mass-spectrometer system for the study of the dynamics of ion-neutral collisions at suprathermal energies is described in detail. The system consists of a Wien Filter, which acts as a source of mass-selected and velocity analyzed ions, coupled to a static-pressure collision chamber followed by a quadrupole mass filter, which acts as a mass analyzer for the products and the projectile ions. This apparatus has been used to measure ion-neutral collision cross sections and ion product times-of-flight. The methods utilized in the processing of raw experimental data are also described. The raw cross section data is corrected with respect to the collection efficiency, yielding integral cross sections which can be used in codes designed to predict the environment of spacecraft in low earth orbit. The performance of the experiment is demonstrated by measuring the known ion-neutral collision systems: N2(+) + Ar, N2(+) + D2, and O(+) + H2O. GRA

N90-27476# Wayne State Univ., Detroit, MI.
DIAGNOSTICS FOR HYDROGEN ATOMS AND MOLECULES IN H-ATOM SOURCES AND BEAMS USING VUV LASER LIGHT Final Technical Report, 1 Sep. 1986 - 31 Dec. 1989
Erhard Rothe 24 Apr. 1990 27 p
(Contract F49620-86-C-0079)
(AD-A222340; AFOSR-90-0528TR) Avail: NTIS HC A03/MF A01 CSCL 20/7

An H(-) ion source for high brightness H atoms beams should have the lowest possible internal temperature T, because the beam-power density at a distance scales as 1/T. The local temperature was determined inside a discharge with the use of a tunable ArF excimer laser that measures the populations of the lowest four rotational states of H2 by means of (2 + 1) resonance enhanced multiphoton ionization (REMPI). The number of laser-created ions causes a proportional change of the discharge's electrical impedance. A calibration in room temperature H2 (without a discharge) showed that the REMPI works well. Another objective is to monitor vibrationally excited molecules, H2(v), that are believed to be the primary origin of H(-) within volume-type ion sources. The same apparatus and approach were used, but add a Raman shifter to change the laser wavelengths to those appropriate for (2 + 1) REMPI of H2(V). GRA

N90-27477# International Business Machines Corp., San Jose, CA.
ULTRASENSITIVE LASER SPECTROSCOPY IN SOLIDS: STATISTICAL FINE STRUCTURE AND SINGLE-MOLECULE DETECTION Interim Report
W. E. Moerner 28 Mar. 1990 39 p Submitted for publication
(Contract N00014-84-C-0708)
(AD-A222391; IBM-RR-RJ7624; TR-25) Avail: NTIS HC A03/MF A01 CSCL 20/5

Detailed studies of the low temperature inhomogeneously broadened 0-0 S(1)-S(0) electronic transition of pentacene dopant molecules in p-terphenyl crystals have produced two novel observations which open up a new regime for ultra-sensitive laser spectroscopy in solids. The first result, direct detection of intrinsic static absorption fine structure on a megaHertzs scale, called statistical fine structure, arises from number fluctuations in the spectral density of absorbers which scale as the square root of the number of absorbers per homogeneous width. Surprisingly, this effect provides a new method for determining the homogeneous width that does not rely on hole-burning or coherent transients. The second recent observation, detection of the optical absorption of a single pentacene molecule in a p-terphenyl crystal, opens the door to new studies of single local environments in solids as well as to studies of the interactions of a single absorber with external perturbations in which no averaging is performed over large numbers of nominally equivalent local configurations. Both achievements utilized high sensitivity variations of laser frequency modulation spectroscopy to perform the measurement. GRA

N90-27478# State Univ. of New York, Buffalo. Dept. of Chemistry.
ELECTRONIC AND STRUCTURAL PROPERTIES OF Si10 CLUSTER
Tapio T. Rantala, Daniel A. Jelski (State Univ. of New York, Fredonia.), and Thomas F. George Jun. 1990 26 p Sponsored in part by American Chemical Society; Research Corp. of New England; Suomen Akatemia, Helsinki, Finland; Tauno Toenning Foundation; and Emil Aaltonen Foundation
(Contract N00014-90-J-1193; NSF CHE-86-20274)
(AD-A222429; UBUFFALO/DC/90/TR-12) Avail: NTIS HC A03/MF A01 CSCL 20/5

Possible structures for Si10 cluster are considered using a tight-binding model and drawing on significant work done in the past. It is shown that the tight-binding parametrization, fitted to the bulk, is also valid for smaller systems. This model is found to essentially reproduce other published results, but requires much less effort than ab initio techniques, thus allowing the study of a wide variety of structures and their ions. However, unlike classical force field calculations, it yields information about the electronic structure of clusters. A new geometric structure for Si10 is found, which is not only of lowest energy, but which also matches the experimental photoelectron band gap and explains the experimental reactivity data. Because of the Jahn-Teller effect, the photoelectron spectrum is very sensitive to geometry. Also, ionization of the cluster alters the geometry slightly. GRA

N90-27479# Stanford Univ., CA.
STATE-TO-STATE ION-MOLECULE REACTION DYNAMICS AT THERMAL ENERGIES Final Technical Report, 1 Nov. 1988 - 31 Oct. 1989
Richard N. Zare 26 Mar. 1990 4 p
(Grant AF-AFOSR-0128-89; AF Proj. 3842)
(AD-A221589; AFOSR-90-0456TR) Avail: NTIS HC A01/MF A01 CSCL 20/5

The laser system purchased from Spectra-Physics delivers over 30 mJ/pulse of tunable light at 280 nanometer with a bandwidth as small as .08 wave numbers. This laser system was

used to measure ion state distributions using high resolution photoelectron kinetic energy spectroscopy. This laser system is also being used to conduct two color ionize/probe experiments, which permit the study of collisional relaxation and charge transfer. GRA

N90-27480# Washington Univ., Seattle. Dept. of Chemistry.
THEORETICAL STUDIES OF TIME-OF-FLIGHT AND ATOM AND MOLECULAR SURFACE COLLISION Final Report, 1 Nov. 1986 - 31 Oct. 1989
Eric J. Heller 4 Apr. 1990 5 p
(Grant AF-AFOSR-0075-87)
(AD-A221705; AFOSR-90-0423TR) Avail: NTIS HC A01/MF A01 CSCL 20/5

The finished work, dealing with cross sections for scattering from defects on surfaces, will be a classic work, since the definition of the cross section had not been done properly before. The second project has to do with trapping and sticking coefficients in low and medium energy collisions of atoms and molecules with surfaces. The aim is to lay to rest the long standing debate regarding the low energy asymptotic limit of sticking coefficients: is it 0 or 1. A student was looking at improvements to the wavepacket code for atom surface collisions. A project was started which involved atom scattering with a vibrating adatom on a surface. Another unfinished project is inspired by some data that was generated on scattering of helium from stepped surfaces. He sees, at certain angles aimed into the steps, a scattering in non-Bragg directions, even though there is supposedly little or no disorder. The scattering is at half the momentum transfer of the perfect surface and rather broad, suggesting that perhaps steps of twice the usual length are involved. GRA

N90-27481# Max-Planck-Inst. fuer Physik und Astrophysik, Garching (Germany, F.R.). Werner-Heisenberg Inst. fuer Physik.
[ACTIVITIES REPORT OF THE WERNER-HEISENBERG INSTITUTE FOR PHYSICS, MUNICH, FEDERAL REPUBLIC OF GERMANY] Annual Report, 1989
[WERNER-HEISENBERG-INSTITUT FUER PHYSIK MUENCHEN, JAHRESBERICHT 1989]
Jan. 1990 148 p In GERMAN Original contains color illustrations
(ISSN-0173-6256; ETN-90-97326) Copyright Avail: NTIS HC A07/MF A01

Theoretical research work was done in the fields of perturbative renormalization, statistical mechanics in the quantum field theory, geometrically formulated description of elementary particles, basic problems of the quantum field theory, the standard model (supersymmetry, strings), elementary particle physics and cosmology, non-relativistic particle physics, and history of physics. The Experimental Division A contributed to experiments on particle physics (CERN), on the tevatron accelerator of the Fermilab (FNAL), on the electron positron storage ring PETRA with the CELLO detector, and on the electron-positron storage ring HERA; a detector for low-energy particles was developed. The Experimental Division B contributed to the LRP project ALEPH, to the CERN SPS experiment NA 32, and to the HEGRA experiment; several detectors were developed. ESA

N90-27482# Kernforschungszentrum G.m.b.H., Karlsruhe (Germany, F.R.). Inst. fuer Kernphysik.
COULOMB-DISSOCIATION OF 156 MeV 6LI-PROJECTILES Thesis - Tuebingen Univ.
J. Kiener Feb. 1990 104 p In GERMAN; ENGLISH summary
(KFK-4691; ISSN-0303-4003; ETN-90-97353) Avail: NTIS HC A06/MF A01

The breakup of 156 MeV 6Li projectiles at 208 Pb with small emission angles of the alpha particle and deuteron fragments is studied. Both fragments are coincidentally detected in the focal plane of a magnetic spectrograph at several reaction angles well below the experimentally determined grazing angle with a relative angle between the fragments of 0 to 2 degrees. Elastic breakup events are separated from other reaction paths due to kinematically complete measurement. Applications of the technique and results in extracting information on astrophysically interesting cross sections are discussed. ESA

73 NUCLEAR AND HIGH-ENERGY PHYSICS

Includes elementary and nuclear particles; and reactor theory.

For space radiation see *93 Space Radiation.*

N90-27483# Continuous Electron Beam Accelerator Facility, Newport New, VA.
RELATIVISTIC EFFECTS IN LOW ENERGY NUCLEON-NUCLEON SCATTERING
Franz Gross, J. W. VanOrden, and Karl Holinde (Kernforschungsanlage, Juelich, Germany, F.R.) 1 Sep. 1989 16 p
(Contracts DE-AC05-84ER-40150; DE-FG05-88ER-40435)
(CEBAF-PR-89-025; WM-89-105) Avail: NTIS HC A03/MF A01; also available from CEBAF Library, 12000 Jefferson Ave., Newport News, VA 23606

It is shown that it is possible to obtain a quantitatively excellent description of low energy NN scattering, including the deuteron, using a relativistic equation with a simple one boson exchange kernel consisting of the exchange of only pi, sigma, rho, and omega mesons. Relativistic properties of the meson-nucleon couplings play an essential role in the success of the description. Author

N90-27484# Westinghouse Hanford Co., Richland, WA.
SP-100 DESIGN, SAFETY, AND TESTING
Gary L. Smith, Carl M. Cox, and Michael M. Mahaffey May 1990 17 p Presented at the American Nuclear Society Topical Meeting on Safety of Non-commercial Nuclear Reactor Research and Irradiation Facilities, Boise, ID, 30 Sep. - 3 Oct. 1990
(Contract DE-AC06-87RL-10930)
(DE90-012643; WHC-SA-0817; CONF-900917-2) Avail: NTIS HC A03/MF A01

The SP-100 Program is developing a nuclear reactor power system that can enhance and/or enable future civilian and military space missions. The program is directed to develop space reactor technology to provide electrical power in the range of tens to hundreds of kilowatts. The major assembly test is to be conducted at the Hanford Site near Richland, Washington, and is designed to validate the performance of the 2.4 Mwt nuclear and heat transport assembly. DOE

N90-27485# Sandia National Labs., Albuquerque, NM. Space Power System Studies Div.
THE SCALABILITY OF OTR (OUT-OF-CORE THERMIONIC REACTOR) SPACE NUCLEAR POWER SYSTEMS
Donald R. Gallup Mar. 1990 76 p
(Contract DE-AC04-76DP-00789)
(DE90-013553; SAND-90-0163) Avail: NTIS HC A05/MF A01

In this document, masses of the STAR-C power system and an optimized out-of-core thermionic reactor (OTR) power system versus power level are investigated. The impacts of key system parameters on system performance are also addressed. The STAR-C is mass competitive below about 15 kWe, but at higher power levels the scalability is relatively poor. An optimized OR is the least massive space nuclear power system below 25 kWe, and scales well to 50 kWe. The system parameters that have a significant impact on the scalability of the STAR-C are core thermal flux, thermionic converter efficiency, and core length to diameter ratio. The emissivity of the core surface is shown to be a relatively unimportant parameter. For an optimized OR power system, the most significant system parameter is the maximum allowable fuel temperature. It is also shown that if advanced radiation-hardened electronics are used in the satellite payload, a very large mass savings is realized. DOE

74 OPTICS

Includes light phenomena; and optical devices.
For lasers see *36 Lasers and Masers.*

N90-27486# Lawrence Livermore National Lab., CA.
HIGH INTENSITY EFFECTS IN RAMAN SCATTERING
Sham Dixit, Mark Hermann, and Tom Karr Jul. 1989 10 p
Presented at the 6th Rochester Conference on Coherence and Quantum Optics, Rochester, NY, 26-28 Jun. 1989 Submitted for publication
(Contract W-7405-eng-48)
(DE90-012093; UCRL-100729; CONF-890652-2) Avail: NTIS HC A02/MF A01

A theoretical framework for describing high intensity multilevel rotational Raman scattering is presented. The formalism, which employs the multipole form of the density matrix equations, is valid at low as well as high intensities, in transient and steady state regimes and, allows for coupling of arbitrary polarizations of the various Stokes/anti-Stokes fields. Several examples are discussed to illustrate the degeneracy effects, effects of a.c. Stark shifts and multilevel effects in rotational Stokes/anti-Stokes Raman conversion. DOE

N90-27487*# National Aeronautics and Space Administration. Pasadena Office, CA.
ALL-OPTICAL PHOTOCHROMIC SPATIAL LIGHT MODULATORS BASED ON PHOTOINDUCED ELECTRON TRANSFER IN RIGID MATRICES Patent Application
David N. Beratan, inventor (to NASA) and Joseph W. Perry, inventor (to NASA) (Jet Propulsion Lab., California Inst. of Tech., Pasadena.) 15 Feb. 1990 26 p
(Contract NAS7-918)
(NASA-Case-NPO-17612-1-CU; NAS 1.71:NPO-17612-1-CU; US-Patent-Appl-SN-480385) Avail: NTIS HC A03/MF A01 CSCL 20F

A single material (not a multi-element structure) spatial light modulator may be written to, as well as read out from, using light. The device has tailored arise and hold times dependent on the composition and concentration of the molecular species used as the active components. The spatial resolution of this device is limited only by light diffraction as in volume holograms. The device may function as a two-dimensional mask (transmission or reflection) or as a three-dimensional volume holographic medium. This device is able to perform incoherent to coherent image conversion or wavelength conversion over a wide spectral range (ultraviolet, visible, or near-infrared regions). NASA

N90-27488*# National Aeronautics and Space Administration. Pasadena Office, CA.
EQUAL PATH, PHASE SHIFTING, SAMPLE POINT INTERFEROMETER FOR MONITORING THE CONFIGURATION OF SURFACES Patent Application
Paul K. Manhart, inventor (to NASA) (Jet Propulsion Lab., California Inst. of Tech., Pasadena.) 23 May 1990 16 p
(Contract NAS7-918)
(NASA-Case-NPO-17913-1-CU; NAS 1.71:NPO-17913-1-CU; US-Patent-Appl-SN-527509) Avail: NTIS HC A03/MF A01 CSCL 20F

A system for monitoring the configuration of a surface (e.g., a segmented parabolic surface) using orthogonally placed retroreflectors at sets of points 1, 2, and 3 dispersed throughout the surface with a stationary halfwave plate (HWP) in the front of the one retroreflector at a corner point 3 and a rotating halfwave plate (RHWP) over a source of linearly polarized coherent light, thereby causing the direction of linear polarization to continuously rotate through 360 deg and causing light returned by the retroreflector at point 3 to be continuously phase shifted through 360 deg relative to light returned by retroreflectors at points 1 and 3. The returned light from each set of points 1, 2, and 3 is focused onto a bed-of-nails (BON) phase grating diagonally oriented with respect to the orthogonal orientation of the incident beams from retroreflectors 1, 2, and 3, thereby causing overlap in the light from points 1 and 3 to produce interferometric signals 1,2 and 2,3. Any change in phase of the interferometric signals 1,2 and 2,3 indicates both the magnitude and direction of any change in the position of the retroreflector at point 3 relative to retroreflectors at points 1 and 2. NASA

N90-27489# Polytechnic Inst. of New York, Brooklyn. Dept. of Physics.
LINEAR AND NONLINEAR OPTICAL PROPERTIES OF QUANTUM DOTS Final Report
K. M. Leung 1990 4 p
(Contract N00014-89-J-2018)
(AD-A223050) Avail: NTIS HC A01/MF A01 CSCL 20/6

The dispersion relation is calculated for artificial optical media consisting of periodic arrays of microparticles embedded in a host medium. The major objective is to utilize photonic bandgap engineering techniques to modify the optical modes in such a way that will drastically alter many optical and electronic processes. GRA

N90-27490# Georgia Inst. of Tech., Atlanta. School of Electrical Engineering.
INTEGRATED OPTICS INTERDIGITATED-ELECTRODE SWITCHES Final Report, Jun. 1986 - Jan. 1990
Thomas K. Gaylord 31 Dec. 1989 75 p
(Contract DAAL03-86-G-0051)
(AD-A223245; ARO-23787.1-EL-F) Avail: NTIS HC A04/MF A01 CSCL 20/6

The diffraction of a pure guided mode in a uniaxial anisotropic slab waveguide by a phase grating which is induced by a voltage applied to interdigitated electrodes over the waveguide has been analyzed. A pure guided mode is decomposed into four plane wave components (two ordinary and two extraordinary), which are not phase matched on the boundary between the waveguide and the grating. Thus the diffraction of a pure guided mode may be decomposed into the diffraction of four plane waves. Three-dimensional vector rigorous coupled-wave diffraction analysis of anisotropic gratings with anisotropic external regions has been used to treat the diffraction of each plane wave component of the pure guided mode. Geometrical and phase/amplitude requirements are identified for the diffracted waves to constitute a guided mode. Diffracted mode efficiencies and Bragg conditions are calculated. Optic axis orientations for efficient diffraction are identified. Example calculations are presented for lithium niobate waveguide Givens rotation devices, and herringbone multiplier structures including a favorable comparison with experimental results. GRA

N90-27491# Arizona Univ., Tucson.
INVESTIGATIONS OF POLARIZED LIGHT SCATTERING FROM ROUGH SURFACES Report, Feb. 1987 - Dec. 1988
William S. Bickel Nov. 1989 130 p
(Contract DAAL03-86-D-0001)
(AD-A221943; CRDEC-CR-053) Avail: NTIS HC A07/MF A01 CSCL 20/6

Polarized light scattering at two visible wavelengths from natural and fabricated surfaces is investigated before and after contamination by liquids of different optical properties. Measurements of the Mueller matrix elements were performed from such surfaces, demonstrating a time dependence of scattering as the liquid diffuses into the surface. The matrix elements found most sensitive to the liquid's presence were also isolated for more detailed analysis. GRA

N90-27492# Pennsylvania Univ., Philadelphia. Dept. of Psychology.
POLARIZATION CONTRAST VISION Annual Report, May 1989 - Apr. 1990
Edward N. Pugh 3 May 1990 8 p
(Contract N00014-89-J-1903; NR Proj. RRO-4106)
(AD-A221423) Avail: NTIS HC A02/MF A01 CSCL 06/4

An attempt is made to establish the possibility that the geometry of certain classes of vertebrate photoreceptors results in a birefringence that allows the animals to utilize the state of

polarization of light striking their retinas as a meaningful stimulus parameter. Simulate the photoreceptors as dielectric waveguides using a simple physical model, and augment this theoretical work with empirical measurements of the light guiding properties of photoreceptors in isolated pieces of retina from a green sunfish (Lepomis cyanellus). With a classical conditioning paradigm, this fish's sensitivity to light is modulated by the orientation of the plane of polarization of linearly polarized light. This functional dependence was predicted by a hypothetical antagonistic mechanism between twin cones of two orientations in the animal's retinal mosaic. Further study is planned for the nature of the stimulus to which the fish is sensitive by creating a camera that will generate images based purely upon the contrast between orthogonal polarizations at each point in space. GRA

N90-27493# BDM Corp., McLean, VA.
OPTICS AND SYMBOLIC COMPUTING Final Report, 15 Jan. 1986 - 15 May 1989
Brian G. Kushner 15 Feb. 1990 301 p
(Contract F49620-86-C-0030)
(AD-A221443; BDM/MCL-90-03363-TR) Avail: NTIS HC A14/MF A02 CSCL 09/5

Optical and optoelectronic technologies have been developing at a very rapid pace over the past decade. This growth has been largely fueled by the fiber optic telecommunications, novel (flat panel) optical scanning and recording systems. These technological advances have also lead to research in insertion of optics into computing systems. The role of optics can be in providing interconnections between electronic subsystems, providing largely capacity data storage or leading to a complete system capable of implementing the necessary operations. The exact role of optics depends on the specific domain of the computing system (signal/image processing, numerical computing or symbolic manipulations) and the nature of application in addresses. GRA

N90-27494# Arizona Univ., Tucson. Dept. of Mathematics.
TRANSITION TO COMPLICATED BEHAVIOR IN INFINITE DIMENSIONAL DYNAMICAL SYSTEMS Final Report, Oct. 1986 - Oct. 1989
Alan C. Newell Mar. 1990 81 p
(Contract F49620-86-C-0130; AF Proj. 3484)
(AD-A221502; AFOSR-90-0506TR) Avail: NTIS HC A05/MF A01 CSCL 20/6

The main goal of the research is to understand nonlinear processes in natural phenomena. There is a strong emphasis on nonlinear optics, a subject which is relatively young and extremely rich in scientific and technological potential. Turbulence in optics, the study of the complex space-time patterns and defects which appear in feedback cavities and counterpropagating beams, is more analytically tractable than its counterpart in fluids. The primary goal of the Center is to provide an environment for research and learning in the Mathematical Sciences. Its basic research themes are the modelling, understanding and applying nonlinear processes in optics, fluids, neural networks, and random distributed systems with continuing investigations into pattern dynamics, percolation, behavior of lattice gases, nonlinear stability, low dimensional chaos, turbulence, dynamical systems and the nature of integrable systems of differential equations. GRA

N90-27495# Air Force Systems Command, Wright-Patterson AFB, OH. Foreign Technology Div.
ADAPTIVE OPTICS CORRECTION IN REAL-TIME FOR DYNAMIC WAVEFRONT ERRORS
Wenhan Jiang 15 Mar. 1990 14 p Transl. into ENGLISH from Guangxue Xuebao (Peoples Republic of China), v. 8, no. 5, p 441-447
(AD-A221588; FTD-ID(RS)T-1023-89) Avail: NTIS HC A03/MF A01 CSCL 20/6

This paper reports on the principles for the use of, and the experimental results obtained from, an adaptive optics system for correcting dynamic wavefront errors in real time. The system consists of a 21-element deformable mirror, a lateral shearing interferometer, and a parallel electronic control system. GRA

N90-27496# Naval Ocean Systems Center, San Diego, CA.
OPTICAL FIBER TO WAVEGUIDE COUPLING TECHNIQUE
D. J. Albares and T. W. Trask (San Diego State Univ., CA.) Mar. 1990 15 p
(AD-A221781; NOSC/TR-1337) Avail: NTIS HC A03/MF A01 CSCL 20/6

A technique for permanently coupling optical fibers edge-on to thin film waveguides was investigated and its feasibility demonstrated. It offers the fine micropositioner adjustment via a needle vacuum chuck for maximum optical coupling, offers robust mechanical support to the fibers from etched Si V-grooves, separates the support and fine adjustment cementing steps to minimize curing and thermal stresses, relaxes the requirements on fiber circularity and concentricity, is compatible with waveguide devices, and is suitable for close-spaced arrays of fibers. GRA

N90-27497# Max-Planck-Inst. fuer Stroemungsforschung, Goettingen (Germany, F.R.).
PARTICLE SIZE DISTRIBUTION DETERMINED FROM MEASURED SCATTERED LIGHT Thesis
Dietmar Felde Feb. 1990 62 p In GERMAN; ENGLISH summary
(MPIS-5/1990; ISSN-0436-1199; ETN-90-97356) Avail: NTIS HC A04/MF A01

A method for measuring particle size distribution is presented. The method is based on the scattering of light by small particles. The scattered light is detected at angles between plus and minus 10 degrees. Assuming that the scattered light of each individual particle will superpose incoherently, a set of linear integral equations is solved to obtain the particle size distribution from the measured light intensities. A system of linear equations which determine the relative particle number of each interval is described. This set of equations is solved using physical assumptions. It is shown that using this method, particles of 1 to 50 micrometers can be measured. ESA

N90-26905# Sandia National Labs., Livermore, CA. Combustion Research Facility.
ADVANCED OPTICAL DIAGNOSTICS IN HYPERSONIC RESEARCH Abstract Only
Robert J. Cattolica *In its* Summary of Discussions at the Eleventh Meeting of the Sandia Cooperative Group on the Aerothermochemistry of Turbulent Combustion Oct. 1988 p 42 (For primary document see N90-26896 21-25)
Avail: NTIS HC A03/MF A01

N90-27145*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
LIDAR INSTRUMENTS PROPOSED FOR EOS
William B. Grant and Edward V. Browell *In its* Earth Sciences Requirements for the Information Sciences Experiment System Jul. 1990 p 61-67 (For primary document see N90-27140 21-43)
Avail: NTIS HC A10/MF A02 CSCL 20F

N90-27153*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
BRIEF STATE-OF-THE-ART REVIEW ON OPTICAL COMMUNICATIONS FOR THE NASA ISES WORKSHOP
Herbert D. Hendricks *In its* Earth Sciences Requirements for the Information Sciences Experiment System Jul. 1990 p 131-137 (For primary document see N90-27140 21-43)
Avail: NTIS HC A10/MF A02 CSCL 20F

75 PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion.
For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

N90-27498# Nagoya Univ. (Japan). Inst. of Plasma Physics.
PROCEEDINGS OF THE US-JAPAN FUSION COOPERATION PROGRAM EXCHANGE P148 WORKSHOP ON ADVANCED CURRENT DRIVE CONCEPTS
S. Tanaka, ed. and K. I. Thomassen, ed. (Lawrence Livermore National Lab., CA.) Mar. 1989 102 p Workshop held in Kyoto, Japan, 6-8 Dec. 1988
(IPPJ-Rev-4) Avail: NTIS HC A06/MF A01

Low frequency, long wavelength instabilities may be excited in a tokamak plasma with current driven by a neutral beam injection. Specifically, when the beam parallel velocity is greater than the Alfven velocity of the background plasma, the Alfven waves are expected to become unstable for high enough beam density and may cause degradation of the beam current. Particle simulations were carried out to study these instabilities and their nonlinear effects on the current. In addition, waves in the ion cyclotron frequency range are also investigated. Author

N90-27499# Japan Atomic Energy Research Inst., Naka.
A STUDY ON THE HEATING AND DIAGNOSTIC OF A TOKAMAK PLASMA BY ELECTROMAGNETIC WAVES OF THE ELECTRON CYCLOTRON RANGE OF FREQUENCIES
Katsumichi Hoshino Sep. 1989 356 p In JAPANESE; ENGLISH summary
(DE90-791312; JAERI-M-89-133) Avail: NTIS (US Sales Only) HC A16

A study on the heating and diagnosis of tokamak plasma by electromagnetic waves of electron cyclotron range of frequency is summarized. The main results obtained are as follows. On the engineering and technology, the technology of injecting high frequency, large power millimeter waves into tokamak plasma was established by carrying out the design, manufacture and test of a 60 GHz, 400 kW high frequency heating system, and the design, manufacture and test of a heterodyne type electron cyclotron radiation multi-channel measuring system were carried out, and the technology of measuring the radiation from tokamak plasma with the time resolution of 10 (mu)s in multi-channel was established. On nuclear fusion reactor core engineering and plasma physics, the high efficiency electron heating of tokamak plasma by the incidence of fundamental irregular and regular waves at electron cyclotron frequency was verified. The discovery and analysis of the heating by electrostatic waves arising due to mode transformation from electromagnetic waves in upper hybrid resonance layer were carried out. By the incidence of second harmonic waves, the high efficiency electron heating of tokamak plasma was verified, and the heating characteristics were clarified. DOE

N90-27500# General Atomic Co., San Diego, CA.
EXPERIMENTS AT HIGH ELONGATIONS IN DIII-D
E. A. Lazarus (Oak Ridge National Lab., TN.), A. D. Turnbull, A. G. Kellman, J. R. Ferron, F. J. Helton, L. L. Lao, J. A. Leuer, E. J. Strait, and T. S. Taylor Jun. 1990 4 p Presented at the 17th European Conference on Controlled Fusion and Plasma Heating, Amsterdam, Netherlands, 25-29 Jun. 1990
(Contracts DE-AC03-89ER-51114; DE-AC05-84OR-21400)
(DE90-013217; GA-A-20057; CONF-900602-12) Avail: NTIS HC A01/MF A01

The limitations to elongation in D-shaped plasmas in the DIII-D tokamak are discussed. It was found that as the triangularity is increased and l(sub i) is decreased that the n = 0 mode takes on an increasingly non-rigid character. The analysis shows two aspects of the behavior; first, an increasing variation of the m/n = 1/0 component across flux surfaces and second, an increase in the relative amplitude of a m/n = 3/0 component which couples to the m/n = 1/0 component and further destabilizes the mode. DOE

N90-27501# Maryland Univ., College Park. Lab. for Plasma and Fusion Energy Studies.
QUANTITATIVE SPECTROSCOPY OF X RAY LASER PLASMAS IN PULSED POWER DEVICES Final Report
May 1990 5 p
(Contract N00014-87-K-2019)
(AD-A221964) Avail: NTIS HC A01/MF A01 CSCL 20/4

A small z-pinch discharge was designed and constructed. Some preliminary studies of the discharge were made using a framing camera, a visible spectrometer and a VUV spectrometer. A quadrature interferometer was designed and its constituent parts were procured. Estimates of the electron density obtained side-on, with the interferometer, and end-on, from VUV measurements of line widths, gave n sub e to be at most roughly 10 to the -17th power/cc. In an effort to augment this density and to obtain a more classical type of z-pinch behavior a second version of the discharge was designed and constructed. A framing camera study of this discharge confirmed the expected behavior and further demonstrated the presence of an unacceptable degree of cylindrical asymmetry. End-on VUV spectra revealed the absence of all lines below roughly 800 A. GRA

N90-27502# California Univ., Berkeley. Dept. of Mechanical Engineering.
LASER SPECTROSCOPY OF PLASMAS Final Report, Jan. 1986 - Jun. 1989
John W. Daily 27 Apr. 1990 28 p
(Grant AF-AFOSR-0067-86; AF Proj. 2308)
(AD-A221978; AFOSR-90-0557TR) Avail: NTIS HC A03/MF A01 CSCL 20/4

A study has been conducted to develop novel advanced laser spectroscopy plasma diagnostic methods. The methods are based on observing the Doppler shift in the absorption lines of ionic species. The two methods studied are Velocity Modulated Laser Spectroscopy and Two-Beam Doppler Shift Laser Spectroscopy. The scientific goal of the work was to increase understanding of plasmas by making non-intrusive fashion. The scientific approach was to combine conventional laser spectroscopies with velocity detection. Using a method such as Rayleigh, fluorescence, or Raman scattering, one probes the Doppler profile of the species of interest, observing shifts in the Doppler profile that arise because of the presence of an electric field. The shift may be related to the ion mobility, and thus conductivity, if the electric field is known, or to the electric field if the mobility is known. Temperature and concentration may be recovered by the conventional means. GRA

N90-27503# SRI International Corp., Menlo Park, CA. Remote Measurements Lab.
PLASMA CLOAKING: AIR CHEMISTRY, BROADBAND ABSORPTION, AND PLASMA GENERATION Final Report
Robert J. Vidmar Feb. 1990 88 p
(Contract F49620-85-K-0013; AF Proj. 2301; SRI Proj. 8656)
(AD-A222044; AFOSR-90-0544TR) Avail: NTIS HC A05/MF A01 CSCL 20/9

Plasmas with electron number densities from 10(exp 9) to 5 x 10(exp 11)/cu cm generated in air or a noble gas constitute tenuous plasmas. If the ambient pressure is near atmospheric, so that the gas density is of the order of 10(exp 16) to 10(exp 19)/cu cm, then the plasma is collisional, and the cold collisional dispersion relation predicts electromagnetic characteristics. A plasma generated by an electron beam or by photoionization produces a spatially decreasing electron density. This spatial electron density, approximated as an Epstein profile, results in low backscatter and high attenuation. Bandwidth and attenuation are quantified. An air-chemistry deionization solution is described that estimates plasma lifetime. The lifetime and electron density are sufficient to estimate the power required by a plasma absorber. Plasmas generated in air require a high input power. A plasma generated in a noble gas, seeded with a readily ionized material, and confined by a membrane, requires much less power, and is technically feasible. GRA

N90-27504# Mission Research Corp., Newington, VA.
THE THEORY AND SIMULATION OF PLASMOID FORMATION AND PROPAGATION Final Technical Report, 1 Jan. 1988 - 30 Sep. 1989
John Brandenburg, Gary Warren, and Richard Worl Jan. 1990 34 p
(Contract F49620-88-C-0049; AF Proj. 2301)
(AD-A222048; MRC/WDC-R-196; AFOSR-90-0535TR) Avail: NTIS HC A03/MF A01 CSCL 20/9

A summary of progress on the theory and simulation of plasmoid formation and propagation is presented. Progress occurred in two areas. First, an analytical model or core-halo dynamics was derived for an arrow-type plasmoid. This model predicts halo expansion that is approximately linear in time with a velocity proportional to the core ion sound speed and a core expansion that is logarithmic in time. Second, simulation efforts have successfully formed and propagated plasmoids with core and halo structure. GRA

N90-27505# Naval Air Development Center, Warminster, PA. Dept. of Air Vehicle and Crew Systems Technology.
HEAT AND MOMENTUM TRANSFER TO TEST SAMPLES IN THE HIGH VELOCITY PLASMA FURNACE Final Report, Jun. - Sep. 1989
Stephen Russ and Thomas Kircher 15 Dec. 1989 21 p Sponsored by ONR, Washington, DC
(AD-A222182; NADC-89115-60) Avail: NTIS HC A03/MF A01 CSCL 20/9

A mass and heat transfer analysis was performed for two sample geometries under high temperature, high velocity air flow conditions. A qualitative picture of the flow fields expected during testing and the effects of the flow on heat transfer and skin friction are presented for square and cylindrical samples. GRA

N90-27506# Ohio State Univ., Columbus. Dept. of Aeronautical and Astronautical Engineering.
LASER DIAGNOSTICS OF PLASMA THRUSTERS Final Report, 1 Dec. 1988 - 30 Nov. 1989
Thomas M. York 1 Apr. 1990 16 p
(Grant AF-AFOSR-0120-89; AF Proj. 2308)
(AD-A221682; AFOSR-90-0636TR) Avail: NTIS HC A03/MF A01 CSCL 21/3

The research involves diagnostics studies of plasma thrusters. These devices generate ionized gases which are accelerated at thermal and electromagnetic modes. The research effort uses the new, high resolution diagnostic techniques that will determine electron densities, local magnetic fields and density fluctuations indicating anomalous transport. A long wavelength carbon dioxide laser which allows more sensitive measurements, with its long wavelength, is used. The laser will be coupled with a Far Infrared Laser System capable of generating beams around ten milliwatt levels, and provide a diagnostic study that has not yet been used in thruster plasma diagnosis. GRA

N90-27507# Naval Research Lab., Washington, DC. Beam Physics Branch.
STABILITY REGIMES IN A HELICAL QUADRUPOLE FOCUSING ACCELERATOR: THEORY AND SIMULATION
J. Krall, C. M. Tang, G. Joyce, and P. Sprangle 4 May 1990 28 p Sponsored in part by NSWC, Silver Spring, MD
(ARPA Order 4395)
(AD-A221755; NRL-MR-6636) Avail: NTIS HC A03/MF A01 CSCL 20/9

The inclusion of helical quadrupole (stellarator) and axial guide fields in high current spiral line or recirculating accelerator configurations provides a high tolerance to energy mismatch and confines the beam against space charge forces. In such a configuration the electron beam can interact with the external fields and with electromagnetic waveguide modes such that the beam centroid can be: (1) orbit unstable independent of the waveguide modes, (2) three-wave unstable, or (3) fully stable. The various stability conditions are presented in the limit of zero beam current. These stability conditions are found to be good predictors of particle simulation results, with minor departures being observed at high current. Linearly unstable modes, obtained via numerical solutions of the dispersion relation, were observed in each simulation. Nonlinear behavior, such as mode saturation in some regimes, was also observed. GRA

76 SOLID-STATE PHYSICS

Includes superconductivity.

For related information, see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers.*

N90-27508# California Inst. of Tech., Pasadena. Div. of Chemistry and Chemical Engineering.
FUNDAMENTAL ELECTRON TRANSFER PROCESSES AT THE SINGLE CRYSTAL SEMICONDUCTOR/LIQUID INTERFACE
Nathan S. Lewis 2 May 1990 4 p
(Contract DE-FG03-84ER-13222)
(DE90-011438; DOE/ER-13222/T1) Avail: NTIS HC A01

During the past three year grant period, efforts were focused on four major areas on investigation. All of these topics are related to the fundamental features of photoinduced charge separation at semiconductor/liquid interfaces. This report presents work in each of the four research areas: cyclic voltammetry theory and current-voltage theory, short wavelength photocurrent measurements, photoelectrochemical processing to make improved solid/state photovoltaic devices, and photoelectrochemistry and surface chemistry of GaAs. DOE

N90-27509# California Univ., Berkeley. Lawrence Berkeley Lab. Materials and Chemical Sciences Div.
PROBLEMS OF ENCLOSED CRYSTAL INTERFACES
U. Dahmen and K. H. Westmacott Nov. 1989 25 p Presented at the Workshop on Interfaces, Bangalore, India, 30 Nov. - 2 Dec. 1989
(Contract DE-AC03-76SF-00098)
(DE90-011594; LBL-28388; CONF-8911194-1) Avail: NTIS HC A03/MF A01

Whereas the shape of a small crystallite within an isotropic medium, i.e., vacuum, a vapor or a liquid, has long been a subject of fundamental interest in materials science the equivalent problem of a crystal enclosed inside another crystal has received relatively little attention. The optimum shape of a solid inclusion in a solid matrix has been treated as a problem of elasticity, and solutions have been given for different shapes, orientations and elastic constants. This approach treats a solid as an anisotropic elastic continuum without direct reference to its crystal structure. The complementary point of view takes into account the effect of crystal structure but neglects elastic or plastic distortions. The latter approach, developed only recently, has been successful in understanding and categorizing the types of crystal defects that can occur in interfaces between two crystals. In the present paper the problem will be examined from both viewpoints in an attempt to highlight the physical principles that underlie the shape and orientation relationship of an enclosed crystal, and these will be related to interfaces and their defects. Although sections of this paper have been published before in a different context the purpose here is to present an overview of some factors that determine solid/solid interface structure. DOE

N90-27510# Ames Lab., IA.
THE EFFECT OF PROCESSING, DEFORMATION AND ANNEALING ON THE MICROSTRUCTURE OF Y1Ba2Cu3O7-(SUB DELTA) Ph.D. Thesis
Myong Ryeong Kim Feb. 1990 74 p
(Contract W-7405-eng-82)
(DE90-011731; IS-T-1417) Avail: NTIS HC A05/MF A01

Early optical and Transmission Electron Microscopy (TEM) studies of the high (Tc) oxide superconductor Y1Ba2Cu3O7-(delta) revealed the structure to be heavily twinned. While some studies have suggested that the twins commonly observed optically arise due to interference effects, the results of other investigations and the present study offer strong evidence that the twins observed

optically are real. Optical and TEM twin measurements were carried out to clarify the discrepancies between reported spacings, to explain the reasons for the noted variation in spacing, and to determine how twin formation is controlled by various TEM sample preparation procedures. It was noted from this work that the twins observed optically in the rare-earth oxide superconductor Y1Ba2Cu3O7-(delta) correspond exactly to those seen by using TEM and that different twin spacings are produced in identical material by different TEM specimen preparation techniques. A major problem associated with comparing the results of various studies concerning the possible effect of twins is that no two studies have examined material which had been processed in exactly the same manner. It was found in the present study that the formation of the twins is highly dependant upon the method of bulk material preparation, with the twin spacing increasing and showing a square-root dependance with increasing grain size. The effect of deformation and post-deformation heat treatments on the twin structure of polycrystalline 123, deformed under controlled conditions of pressure, temperature and strain rate, was also investigated. The twin spacing seen in the reoxygenated samples follows the same square-root dependance with grain size as does the undeformed material. DOE

N90-27511# Los Alamos National Lab., NM.
PULSED LASER DEPOSITION OF HIGH (Tc) SUPERCONDUCTING THIN FILMS: PRESENT AND FUTURE
X. D. Wu, T. Venkatesan, A. Inam, X. X. Xi, Q. Li, Chuan C. Chang, R. Ramesh, D. M. Hwang, L. Nazar, and B. Wilkens (Bell Communications Research, Inc., Red Bank, NJ.) et al 1990 12 p Presented at the Spring Meeting of the Materials Research Society, San Francisco, CA, 16-21 Apr. 1990 Prepared in cooperation with La Plata Univ., Argentina
(Contract W-7405-eng-36)
(DE90-011950; LA-UR-90-1526; CONF-900466-50) Avail: NTIS HC A03/MF A01

Pulsed laser deposition (PLD) has been widely used for deposition of high (Tc) superconducting thin films, and has been approved as one of the best physical vapor techniques to prepare the films. The most important advantage of this technique is stoichiometric deposition, namely the films could be made with the same composition of the targets. Utilized PLD, not only thin films but also multilayers and superlattices of high (Tc) superconductors were fabricated. The performance of the technique is reviewed, and the future is speculated upon. DOE

N90-27512# Lawrence Livermore National Lab., CA.
INTEGRATION OF PICOSECOND GaAs PHOTOCONDUCTIVE DEVICES WITH SILICON CIRCUITS FOR OPTICAL CLOCKING AND INTERCONNECTS
Jeffrey Morse, Raymond P. Mariella, Gregory Anderson, and Robert Dutton (Stanford Univ., CA.) 1990 7 p Presented at the 3rd International Congress on Optical Science and Engineering, The Hague, Netherlands, 12-16 Mar. 1990 Submitted for publication
(Contract W-7405-eng-48)
(DE90-012096; UCRL-102733; CONF-900368-4) Avail: NTIS HC A02/MF A01

GaAs layers have been grown on silicon substrates by Molecular Beam Epitaxy (MBE), from which photoconductive circuit elements (PCE) have been fabricated. A fabrication procedure will be described which is fully compatible with standard silicon IC processing technology. Results will be presented demonstrating the reliance of GaAs PCE performance on epitaxial growth conditions and subsequent processing steps. PCE response speeds ranging from less than 10 ps to 60 ps have been observed. DOE

N90-27513# California Univ., Davis. Dept. of Electrical Engineering and Computer Science.
DESIGN OF GaAs CHARGE COUPLED DEVICES Final Report
Nazmul Ula and C. E. Hunt 1990 46 p
(Contract W-7405-eng-48)
(DE90-012124; UCRL-CR-103854) Avail: NTIS HC A03/MF A01

The technology of Charge Coupled Devices (CCD's) in silicon has matured to the point where application of these devices in imagers has become widespread. Certain applications which are conceptually well suited to CCD implementation, such as high speed signal processing and fast response imagers, are difficult to obtain with silicon CCD technology. These limitations are direct consequences of silicon material properties, such as low electron mobility and high intrinsic carrier concentration. The higher electron mobility and wider bandgap of GaAs compared to silicon make GaAs a potentially more desirable material for high speed CCD technology. Operation of GaAs CCD's up to 4.2 GHz has been reported. Significant performance advantages can result from the wider bandgap (1.9 eV) of GaAs and its related alloys. Small increases in bandgap result in orders of magnitude reductions in intrinsic carrier concentration and correspondingly low dark current. This low dark current in GaAs can potentially lead to imaging devices with room temperature charge integration/storage times of hours rather than fractions of a second. The proposed project, to be completed in three phases, is to design a GaAs CCD imager for high speed transient capture. DOE

N90-27514# Sandia National Labs., Albuquerque, NM.
FLUX MOTION EFFECTS IN Tl-Ca-Ba-Cu-O THIN FILMS
C. P. Tigges, E. L. Venturini, D. S. Ginley, J. F. Kwak, B. Morosin, J. C. Barbour, R. J. Baughman, R. P. Hellmer, T. E. Zipperian, and J. S. Martens 1990 10 p Presented at the Conference on the Science and Technology of Thin Film Superconductors, Denver, CO, 30 Apr. - 4 May 1990
(Contract DE-AC04-76DP-00789)
(DE90-012176; SAND-90-1228C; CONF-900424-3) Avail: NTIS HC A02/MF A01

Flux motion effects, flow and creep, have been identified as one of the major problem areas in high temperature superconductors. In this paper, we examine these effects in polycrystalline thin films of the Tl--Ca--Ba--Cu--O high temperature superconductors. Films with transport critical current densities to 9 times 10 to the 5th power A/sq cm at 77 K and no weak-link behavior have been obtained. The activation energy for flux motion as a function of temperature has been determined by static magnetization and magnetotransport measurements. Estimated activation energies at 77 K from these techniques are 200 meV at 50 mT and 41 meV at 1 T, respectively. We discuss a new superconducting device, the superconducting flux flow transistor, fabricated from photolithographically patterned films, that utilizes switching between the superconducting and flux flow states as the active device mode. These devices show the potential for operation to 60 GHz utilizing the current films. DOE

N90-27515# Michigan Univ., Ann Arbor. Dept. of Electrical Engineering.
INVESTIGATION ON THE MBE GROWTH AND PROPERTIES OF AlGaInAs/InP AND InGaAs-InAlAs SUPERLATTICES Final Report, 15 Apr. 1986 - 14 Dec. 1989
P. K. Bhattacharya and R. Gibala Dec. 1989 16 p
(Contract DE-FG02-86ER-45250)
(DE90-012248; DOE/ER-45250/3) Avail: NTIS HC A03/MF A01

The results presented in this report cover work carried out during the period May 15, 1986 to December 14, 1989. The focus of the work has been to grow wide-bandgap ternary and quaternary semiconductors InAlAs and InGaAlAs by molecular beam epitaxy and to investigate their electronic, optical and structural characteristics. The techniques being used are x ray, TEM, photoluminescence and absorption, DLTS, Hall transport, and Raman spectroscopy. The experiments have included both lattice matched and strained layers. A series of InGaAlAs quaternary alloys lattice matched to InP, covering the bandgap range from 0.75 to 1.45 eV were grown. Low temperature photoluminescence measurements indicate that the layers are possibly the best even grown. The excitonic linewidths are extremely narrow and indicate minimal amounts of clustering. Detailed structural characterization of strained InGaAs/InAlAs on GaAs, by TEM has been done. The purpose of this study was two-fold: first, to understand the growth

kinetics during strained epitaxy and the generation and propagation dislocations; and second, to study the growth of this mismatched layers for device applications. DOE

N90-27516# Oak Ridge National Lab., TN. Solid State Div.
THE COLUMN-BY-COLUMN COMPOSITIONAL MAPPING AT SEMICONDUCTOR INTERFACES USING Z-CONTRAST STEM
D. E. Jesson, S. J. Pennycook, and J.-M. Baribeau (National Research Council of Canada, Ottawa, Ontario) May 1990 9 p Presented at the Spring Meeting of the Materials Research Society, San Francisco, CA, 16-21 Apr. 1990 Submitted for publication
(Contract DE-AC05-84OR-21400)
(DE90-012594; CONF-900466-59) Avail: NTIS HC A02/MF A01

A new strategy for atomic resolution compositional mapping at semiconductor interfaces is presented. Images can be interpreted directly to within 10 percent to give column-by-column compositional information with a sensitivity approaching Rutherford scattering cross sections. The method is applied to obtain the first atomic resolution images of interfacial ordering in ultrathin (Si(sub m)Ge(sub n))(sub p) superlattices and attribute the results to growth on (2 x 1) and (1 x 2) reconstructed surfaces. DOE

N90-27517*# National Aeronautics and Space Administration. Pasadena Office, CA.
GROWTH OF III-V FILMS BY CONTROL OF MBE GROWTH FRONT STOICHIOMETRY Patent Application
Frank J. Grunthaner, inventor (to NASA), John K. Liu, inventor (to NASA), and Bruce Hancock, inventor (to NASA) (Jet Propulsion Lab., California Inst. of Tech., Pasadena.) 28 Feb. 1990 13 p
(Contract NAS7-918)
(NASA-Case-NPO-17724-1-CU; NAS 1.71:NPO-17724-1-CU; US-Patent-Appl-SN-488578) Avail: NTIS HC A03/MF A01 CSCL 20L

For the growth of strain-layer materials and high quality single and multiple quantum wells, the instantaneous control of growth front stoichiometry is critical. The process of the invention adjusts the offset or phase of molecular beam epitaxy (MBE) control shutters to program the instantaneous arrival or flux rate of In and As4 reactants to grow InAs. The interrupted growth of first In, then As4, is also a key feature. NASA

N90-27518*# National Aeronautics and Space Administration. Pasadena Office, CA.
METHOD OF FORMING THREE-DIMENSIONAL SEMICONDUCTOR STRUCTURES Patent Application
Robert W. Fathauer, inventor (to NASA) (Jet Propulsion Lab., California Inst. of Tech., Pasadena.) 18 May 1990 15 p
(Contract NAS7-918)
(NASA-Case-NPO-17835-1-CU; NAS 1.71:NPO-17835-1-CU; US-Patent-Appl-SN-524959) Avail: NTIS HC A03/MF A01 CSCL 20L

Silicon and metal are coevaporated onto a silicon substrate in a molecular beam epitaxy system with a larger than stoichiometric amount of silicon so as to epitaxially grow columns of metal silicide embedded in a matrix of single crystal, epitaxially grown silicon. Higher substrate temperatures and lower deposition rates yield larger columns that are farther apart while more silicon produces smaller columns. Column shapes and locations are selected by seeding the substrate with metal silicide starting regions. A variety of three-dimensional, exemplary electronic devices are disclosed. NASA

N90-27519# Argonne National Lab., IL. Materials Science Div.
PREPARATION AND MAGNETIC MEASUREMENTS OF SINGLE CRYSTAL Tl2Ba2CaCu2O8
J. Z. Liu, Y. X. Jia, P. Klavins, R. N. Shelton (California Univ., Davis.), J. Downey, and D. J. Lam May 1990 16 p Presented at the 8th American Conference on Crystal Growth, Vail, CO, 15-20 Jul. 1990 Submitted for publication
(Contracts W-31-109-eng-38; W-7405-eng-48)
(DE90-013657; CONF-900738-1) Avail: NTIS HC A03/MF A01

A novel self-flux growth technique has been used to prepare superconducting single crystals with transition temperatures, (Tc), ranging from 105 to 124 K in the Tl-Ca-Ba-Cu-O system. Measurements of the magnetic hysteresis and magnetic relaxation in Tl2Ba2CaCu2O8 crystals reveal extraordinary flux creep behavior that persists at low temperatures. These effects are attributed to the lack of effective pinning centers in these materials. DOE

N90-27520# Argonne National Lab., IL. Materials Science Div.
SYMMETRY BREAKING OXYGEN DISPLACEMENT IN SUPERCONDUCTING OXIDES
T. Egami, B. H. Toby, S. Billinge, P. K. Davies, W. Dmowski, J. D. Jorgensen, M. A. Subramanian, and A. W. Sleight (California Univ., Santa Barbara.) Sep. 1989 3 p Presented at the International Conference on Materials and Mechanisms of Superconductivity: High-Temperature Superconductors, Stanford, CA, 23-28 Jul. 1989 Submitted for publication
(Contract W-31-109-eng-38; NSF DMR-86-17950; NSF DMR-85-19059)
(DE90-013670; CONF-890718-37) Avail: NTIS HC A01/MF A01

Atomic pair distribution analysis of pulsed neutron scattering data for superconducting oxides indicates that some of the atoms, notably oxygen atoms, are displaced from the crystallographic high-symmetry sites, breaking the local symmetry. Anomalous displacements are seen in Tl-Ba-Ca-Cu-O in the vicinity of the superconducting transition temperature, suggesting an unusual nature of the superconducting state of this compound. DOE

N90-27521# Brookhaven National Lab., Upton, NY. Applied Physics Div.
FRACTURE-EXAFS: A NEW METHOD FOR THE STUDY OF INTERFACES IN THIN FILMS AND POLYCRYSTALLINE MATERIALS
E. V. Barrera, B. Maruyama (Naval Research Lab., Washington, DC.), and S. M. Heald 1990 7 p Presented at the Spring Meeting of the Materials Research Society, San Francisco, CA, 16-21 Apr. 1990 Sponsored in part by ONR and NAS-NRC
(Contract DE-AC02-76CH-00016)
(DE90-013736; BNL-44732; CONF-900466-70) Avail: NTIS HC A02/MF A01

Fracture Extended X-ray Absorption Fine Structure (EXAFS) is a technique, proposed here for the first time, which combines an appropriate mechanical test with EXAFS analysis to investigate the atomic processes involved in the fracture process. Fracture-EXAFS builds upon the fracture-Auger electron spectroscopy technique, which was used to study the elemental composition of fracture surfaces, and has yielded significant insight into phenomena such as grain boundary embrittlement and composite interface fracture. EXAFS analysis yields structural, as well as chemical information. The identity, coordination number, position and degree of disorder of atoms in the vicinity of interfaces and surfaces can be determined. Thus, EXAFS comparison of the imminent (latent) fracture surface to the fracture surface can yield structural, as well as chemical information about the fracture process. In this preliminary report, emphasis will be given to the application of Fracture-EXAFS to the study of interfaces in thin films. Discussion will also include the use of Fracture-EXAFS to study grain boundaries in polycrystalline materials. DOE

N90-27522# Virginia State Univ., Petersburg.
CHARACTERIZATION OF SUPERCONDUCTING MATERIALS WITH MUON SPIN ROTATION Annual Report, 1 Feb. 1989 - 31 Jan. 1990
Carey E. Stronach 22 Jan. 1990 7 p
(Contract DE-FG05-88ER-45353)
(DE90-013755; DOE/ER-45353/2) Avail: NTIS HC A02/MF A01

During the past year the muon spin rotation researchers at Virginia State University have participated in extensive sets of muon spin rotation experiments on superconducting materials, related materials, and other classes of materials at Brookhaven National Laboratory (BNL) and the Tri-University Meson Facility (TRIUMF). Several students have received training in these

research techniques, data analysis is underway, and the experimental and computer equipment have been upgraded. This report briefly discusses work done during the last year. DOE

N90-27523# Oak Ridge National Lab., TN.
THE EPITAXIAL GROWTH OF COPPER ON THE (111) SURFACE OF SILICON
F. J. Walker, R. A. McKee, and J. R. Conner (Cornell Univ., Ithaca, NY.) 1990 9 p Presented at the Spring Meeting of the Materials Research Society, San Francisco, CA, 16-21 Apr. 1990
(Contracts DE-AC05-84OR-21400; AFOSR-ISSA-89-0015)
(DE90-013817; CONF-900466-72) Avail: NTIS HC A02/MF A01

The progression of the epitaxy of Cu(111) on Si(111) was studied using surface sensitive techniques and the as-grown film studied using high resolution transmission electron microscopy (HRTEM). A molecular beam epitaxy (MBE) system has been used to deposit films on 3-inch-diameter silicon substrates. Across this large area a graded thickness of 0 to 10 nm of copper was deposited and scanned using Auger electron spectroscopy (AES) and low energy electron diffraction (LEED). For films grown at 373 K, silicon alloys with the copper up to a thickness of 2.5 nm, consistent with previous studies. LEED indicates an ordered R30 degree - the square root of 3 x the square root of 3 Cu(111) surface which results from the alloying of copper and silicon. HRTEM images from the interface region show the alloy to be 2.0 nm thick, crystalline, and epitaxial to the Si(111) surface. There are indications that the interface alloy may be a metastable copper silicide. This alloy is important in the mechanism for the growth of Cu(111) on Si(111). DOE

N90-27524# Technion Research and Development Foundation Ltd., Haifa (Israel).
RAPID ANNEALING OF IRON IMPLANTED Hg(1-x)Cd(x)Te Final Technical Report, 1 Oct. 1986 - 28 Feb. 1990
Rafael Kalish Mar. 1990 45 p
(Contract DAJA45-86-C-0011)
(AD-A222777; R/D-5231-EE-01) Avail: NTIS HC A03/MF A01 CSCL 09/1

Different Rapid Thermal Annealing techniques were employed to achieve damage removal and electrical activation of dopants in ion implanted Hg(1-x)Cd(x)Te (x = 0.2, 0.3). As seen by Rutherford Backscattering Spectrometry combined with channeling and Auger measurements annealings with a CO2 laser or a flash lamp lead to good removal of implantation damage without causing changes in the stoichiometry. These techniques, however, suffer from complexity and lack of reproducibility. The new simple method for RTA of mercury containing crystals Annealing by immersion in a how MErcury BAth (AMEBA) which was developed within the present project was found to be comparable to other more complicate techniques as for improving the electrical properties of HgCdTe as deduced from Hall and differential Hall measurements. GRA

N90-27525# Virginia Univ., Charlottesville.
THE 2ND INTERNATIONAL CONFERENCE ON LOW-ENERGY DISLOCATION STRUCTURES Final Report
William A. Jesser May 1990 6 p Conference held in Charlottesville, VA, 13-17 Aug. 1989
(Contract DAAL03-89-G-0083)
(AD-A222887; ARO-26614.2-MS-CF) Avail: NTIS HC A02/MF A01 CSCL 20/2

The scope and purpose of the second international conference on low-energy dislocation structures was to examine the extent to which the concepts of dislocation energy minimization per unit line length have been successfully incorporated into those areas of interest in which these concepts have traditionally been ignored, such as fracture, radiation damage, highly deformed materials and friction/wear. The fruitful and extensive application of the LEDS concepts in such areas as epitaxy and crystal growth serve as a useful basis for comparison. GRA

N90-27526# California Univ., Los Angeles. Dept. of Electrical Engineering.
MEASUREMENT OF DEEP LEVELS AT InGaAs(P)/InP HETEROJUNCTIONS Final Report, 1 Sep. 1986 - 31 Dec. 1989
Stephen R. Forrest 1 Apr. 1990 69 p
(Contract DAAL03-86-K-0155)
(AD-A222890; ARO-23906.4-EL) Avail: NTIS HC A04/MF A01 CSCL 09/1

The properties were studied of semiconductor heterojunctions using several novel analytical and experimental techniques. A new, and highly accurate means for measuring the properties of heterojunctions was demonstrated, where the measurements of the band offset energies can be made even in the presence of high densities of interface charge. The techniques developed were applied to study both InGaAs/InP as well as HgCdTe/CdTe heterojunctions, affording the most accurate measurements obtained to date possible via the use of novel test structures consisting of organic-on-inorganic semi-conductor contact barrier diodes. Furthermore, InGaAs/InP heterojunctions were grown with the lowest defect densities yet reported, and obtained the surprising result that the defect charge density is independent of the degree of lattice mismatch. GRA

N90-27527# Air Force Inst. of Tech., Wright-Patterson AFB, OH. School of Engineering.
DEFECTS ASSOCIATED WITH THE INCORPORATION OF GERMANIUM IN GALLIUM ARSENIDE Ph.D. Thesis
Kevin J. Keefer Jun. 1990 184 p
(AD-A222953; AFIT/DS/ENP/90-1) Avail: NTIS HC A09/MF A01 CSCL 07/2

Above and below bandgap excitation studies were performed on Gallium Arsenide samples implanted with Germanium to assess the nature of impurities and defects associated with the incorporation of this element. In addition, dual implanted GaAs samples ((Ge+Ga and Ge+As)) were also investigated to further facilitate the characterization and identification of probable stoichiometric defects. The luminescence results are presented for samples implanted with various doses of ions spanning 1E13-1E15 1/(centimeters squared) at an energy of 120 kilo electron volts, and annealed for 15 minutes at a temperature of 900 deg C. GRA

N90-27528# Wright Research Development Center, Wright-Patterson AFB, OH. Avionics Lab.
HIGH TEMPERATURE SUPERCONDUCTIVITY APPLICATIONS FOR ELECTRONIC WARFARE AND MICROWAVE SYSTEMS Final Report, Mar. 1988 - Mar. 1990
Paul Andrew Ryan May 1990 21 p
(AD-A222972; WRDC-TR-90-1080) Avail: NTIS HC A03/MF A01 CSCL 20/3

The discovery in 1987 of high temperature superconductivity (HTSC) in ceramic oxide compounds has given the Electronic Warfare and Microwave community another technology to help reach some of their most demanding goals. The near term applications will be in passive microwave components, providing reduced insertion loss, smaller circuit and device size, and higher quality factor circuitry with less heat dissipation. Other applications are farther away and may not have even been conceived as of yet. All applications need to be assessed for their overall payoff compared to conventional technology to determine if the benefits of using superconductivity warrant cryogenic cooling. GRA

N90-27529# Maryland Univ., College Park.
ELECTRON-PHONON INTERACTION AND TRANSPORT IN ARTIFICIALLY MADE SEMICONDUCTOR MICROSTRUCTURES Final Report, Oct. 1985 - Dec. 1989
Sankar DasSarma Mar. 1990 17 p
(Contract DAAG29-85-K-0233)
(AD-A223061; ARO-23220.1-EL) Avail: NTIS HC A03/MF A01 CSCL 20/12

A wide area of transport and electron phonon interaction processes in artificially made semiconductor microstructures were examined including a complete theory for picosecond relaxation

phenomena and hot electron energy loss in semiconductor heterostructures and quantum wells, a theory for inelastic scattering in ballistic hot electron transistors, a theory for elementary excitations in low dimensional semiconductor microstructures, a theory for the quasiparticle properties of semiconductor microstructures and a theory of band gap renormalization. The theory includes plasmon phonon coupling, dynamical screening slab and interface phonon effects. The calculated results are in excellent quantitative agreement with the available experimental results in semiconductor microstructures. The quantitative theoretical results will be of use to a wide class of next-generation transistor and opto-electronic devices which are based on artificial semiconductor microstructures. These include high electron-mobility transistors, ballistic hot electron transistors, resonant tunneling diodes and various nonlinear opto-electronic devices. GRA

N90-27530# California Univ., Berkeley.
HIGH CURRENT METAL ION IMPLANTATION Final Report, 19 Dec. 1988 - 18 Jun. 1989
Ian G. Brown 20 Apr. 1990 24 p
(Grant MIPR-ARO-115-89)
(AD-A223098; ARO-26703.1-MS) Avail: NTIS HC A03/MF A01 CSCL 20/9

This report summarizes the research and development that has been carried out at Lawrence Berkeley Laboratory to develop a novel kind of high current metal ion source for metallurgical surface modification application. In ion implantation, an energetic ion beam is injected into a solid surface with the result that the surface composition is changed. For the case when the surface is a metal, the tribological properties of the new metallurgical surface can be significantly improved over the unimplanted surface. Previously, however, very intense metal ion beams have not been available, and this has been an impedance to the development of the field. With the MEVVA (Metal Vapor Vacuum Arc) ion source, metal ion beam currents of very high intensity have become available. This report outlines the progress made under the funded program in the four areas addressed: development of the MEVVA ion source for ion implantation application; research on the ion beam characteristics and behavior; development of the ion implantation facility; metallurgical ion implantation research that was performed. GRA

N90-27531# Gordon Research Conferences, Inc., Kingston, RI.
THE 1990 GORDON RESEARCH CONFERENCE ON CRYSTAL GROWTH Final Report, 1 Mar. - 31 Oct. 1990
Margaret Brown Apr. 1990 10 p Conference held in Oxnard, CA, 11-16 Mar. 1990
(Contract DAAL03-90-G-0065)
(AD-A223218; ARO-27332.1-EL-CF) Avail: NTIS HC A02/MF A01 CSCL 20/2

The program was designed to present a range of topics and views within the broad theme of the conference. Sessions included papers on bulk and thin film crystal growth experiments and modeling, high T sub c superconductors (uses and crystal growth), II-VI compounds, and crystal characterization. Twenty full length papers were presented in eight sessions, chaired by acknowledged experts in the session field. Each session chair gave an introduction to his session and fostered discussions following the presentations. Two papers included impressive videotape displays of the theory and practice of crystal growth that greatly enhanced the understanding of the subjects verbally presented. The format of the Gordon conference allows ample unstructured time for informal discussion of program and other related topics, and participants remarked on how much they enjoyed these active discussion periods to pursue points brought up in the formal sessions. Students and newcomers to the crystal growth community gained much from interacting informally with experienced scientists and learning from them. One session devoted to short verbal presentations of posters, to introduce authors and topics to the audience, proved to be a very successful experiment. Poster viewing sessions followed later, when authors were able to discuss their work in more detail. GRA

N90-27532# Naval Surface Warfare Center, Silver Spring, MD. Dept. of Research and Technology.
FABRICATION OF COMPOSITE HIGH TEMPERATURE SUPERCONDUCTOR WIRES FROM Ag/YBa2Cu3O(SUB x) POWDER PRODUCED BY AgNO3 DECOMPOSITION Report, 1988 - 1989
William A. Ferrando 30 Mar. 1990 45 p Sponsored by NRL and ONR
(AD-A221936; NSWC/TR-89-338) Avail: NTIS HC A03/MF A01 CSCL 20/3

A brief discussion of the history and generic properties of superconductors is given. Arguments favoring the use of microscopically uniform silver additions to the high temperature superconducting ceramic oxide powders are made. After treating some conventional Ag deposition methods and their shortcomings in this application, a novel, inexpensive method involving the decomposition of AgNO3 is presented. Conventional wire fabrication methods, as adapted to processing the high temperature superconductor materials, are discussed. Test equipment for measurement of the important superconducting properties of critical temperature (Tc) and critical current (Jc) is described. Finally, some early results on wire segments fabricated at the Naval Surface Warfare Center (NSWC) are given. GRA

N90-27533# Cornell Univ., Ithaca, NY. Dept. of Chemistry.
SYNTHESIS, STRUCTURE, AND PROPERTIES OF Ca2ZnN2 Technical Report No. 6, 1989 - 1990
Ming Y. Chern and Francis J. DiSalvo 30 Apr. 1990 23 p Submitted for publication
(Contract N00014-88-K-0139)
(AD-A222012) Avail: NTIS HC A03/MF A01 CSCL 07/2

We report the synthesis and physical properties of the new ternary nitride Ca2ZnN2 (calcium zinc nitride), prepared by the reaction of Ca3N2 and Zn in N2 gas at 680 C. The structure, determined by x ray powder diffraction and refined by Rietveld profile analysis, is tetragonal (I 4/m m m) with a=3.5835(4) A, c=12.6583(7)A, and Z=2. The structure features condensed nitrogen-centered metal octahedra and a linear coordination of Zn by two nitrogen atoms. Conductivity and magnetic measurements show that Ca2ZnN2 is insulating and diamagnetic. GRA

N90-27534# Crystallume, Menlo Park, CA.
POLYCRYSTALLINE DIAMOND JUNCTION FIELD EFFECT TRANSISTORS (JFETS) Progress Report
Maurice Landstrass and Dale Moyer 1 Jun. 1990 13 p
(Contract N00014-89-C-0150; NR Proj. S40-5018)
(AD-A222238) Avail: NTIS HC A03/MF A01 CSCL 20/12

Diodes were fabricated from in situ doped N-diamond/P-diamond layer structures. The N-dopants investigated were nitrogen and oxygen. The majority of the diodes fabricated to date have has either leaky characteristics or displayed high series resistance. As these diodes are designed to be gate electrodes, series resistance may be acceptable. SIMS measurements were performed on polycrystalline diamond films of diode structures to evaluate the doping efficiency of boron, nitrogen and oxygen. Boron doping efficiency was found to be very high with measured doping concentrations (polydiamond) of 5 x 10(exp 21) boron/cu cm (based on a boron doped single crystal diamond calibration). The dopant concentrations, as measured by SIMS, of both nitrogen and oxygen was found to be too low, in the films analyzed, to create the desired N+(deep donor)/P+(boron) diamond diodes. The diode doping levels are limited by the currently achievable donor dopant concentrations to approximately 1.0 x 10(exp 19)/per cu cm. Electron channelling measurements were performed on boron doped diamond grown on type IIA natural diamond. These measurements confirmed the epitaxial relationship between CVD diamond layers grown in the plasma apparatus used. GRA

N90-27535# Utah Univ., Salt Lake City. Dept. of Chemistry.
IDENTIFICATION OF TETRAGONAL AND CUBIC STRUCTURES OF ZIRCONIA Technical Report, Jun. 1989 - May 1990

Ram Srinivasan, Robert J. DeAngelis, Gene Ice, Stanley F. Simpson, Joel M. Harris, and Burtron H. Davis (Kentucky Univ., Lexington.) 29 May 1990 37 p Submitted for publication
Sponsored by Kentucky Univ.
(Contracts N00014-89-J-1412; DE-FG05-85ER-45186)
(AD-A222373; TR-20-ONR) Avail: NTIS HC A03/MF A01 CSCL 20/2

X ray diffraction from a synchrotron source was employed in an attempt to identify definitively the crystal structures in zirconia ceramics produced by sol-gel method. The particles of chemically precipitated zirconia, after calcination below 600 C, are very fine, and have a diffracting particle size in the range of 7 to 15 nm. Since the tetragonal and cubic structures of zirconia have very similar lattice parameters, it is difficult to distinguish between the two. The tetragonal structure can be identified only by the characteristic splittings of the Bragg profiles from the c index planes. However, these split Bragg peaks from the tetragonal phase in zirconia overlap with one another due to particle size broadening. In order to distinguish between the tetragonal and cubic structures of zirconia, three samples were studied using synchrotron radiation. GRA

N90-27536# Minnesota Univ., Minneapolis. Dept. of Chemistry.
DESIGN OF ORGANIC NONLINEAR OPTICAL MATERIALS End of the Year Report
Margaret C. Etter Jun. 1990 9 p
(Contract N00014-89-J-1301)
(AD-A222400) Avail: NTIS HC A02/MF A01 CSCL 20/2

This project deals with a new approach to designing organic nonlinear optical materials for second harmonic generation based on the use of hydrogen bonding to organize molecules into acentric arrays. Since crystal engineering is not a well developed science, crystal packing patterns can not yet be predicted for even simple organic molecules. For organic nonlinear optical materials this dilemma means that even the most promising organic molecule may have poor to nonexistent nonlinear optical properties because it forms centric crystals or crystals with unfavorable molecular dipole alignments. The work is aimed at gaining control over the crystal growth process by understanding the molecular basic for aggregation and nucleation. Using hydrogen bonds as one of the strongest, most prevalent, and most easily identified intermolecular interactions, it was found that the primary structure of hydrogen bonded aggregates can be predicted based on functional group complementarity and stereoelectronic considerations. This information is used to choose (or synthesize) molecules with hydrogen bonding groups positioned on the molecules so that acentric hydrogen bonded aggregates must necessarily form. GRA

N90-27537# Massachusetts Inst. of Tech., Cambridge. Dept. of Chemistry.
FACE-SPECIFIC INTERACTION OF MoS4(2-) WITH ORIENTED CRYSTALS OF (0001) CdX(X = Se, S) Interim Technical Report, May 1989 - May 1990
James J. Hickman and Mark S. Wrighton 17 May 1990 17 p Submitted for publication
(Contract N00014-84-K-0553)
(AD-A222405; TR-35) Avail: NTIS HC A03/MF A01 CSCL 07/4

Oriented (0001) Cdx (X = S, Se) crystals selectively adsorb MoS4(2-) (Molybdenum tetrasulfide ion) onto the Cadmium-rich faces. Binding of MoS4(2-) is effected by dipping the CdX crystals into CH3CN (acetonitrile) containing 20 mM (Et4N)2MoS4. Removal of the crystal from the solution followed by rinsing with CH3CN leaves MoS4(2-) on the Cd- but not X-rich face of the crystal as detected by x ray photoelectron spectroscopy (XPS) and Auger electron spectroscopy (AES). The specificity for Cd-face vs. X-face binding is typically greater than 5:1 as determined by XPS and AES data for both faces of the same crystal. S element maps for the MoS4(2-)-modified, Cd-face of CdSe crystals reveal non-uniform binding of MoS4(2-). There is a correlation of the regions of MoS4(2-) binding with the crystal planes revealed in the pretreatment/etch procedure. GRA

N90-27538# Columbia Univ., New York, NY. Dept. of Electrical Engineering.
MOLECULAR BEAM EPITAXIAL GROWTH, CHARACTERIZATION, AND DEVICES OF MODULATED SEMICONDUCTOR STRUCTURES Final Report, 1 Feb. 1989 - 31 Jan. 1990
Wen I. Wang 28 Feb. 1990 31 p
(Contract N00014-89-K-2020; AF-AFOSR-0215-89; AF-AFOSR-0126-88; AF Proj. 2917)
(AD-A221545; AFOSR-90-0480TR) Avail: NTIS HC A03/MF A01 CSCL 07/2

Substrate stabilized metastable single crystal germanium (1-x) stannide (x) films can be grown by molecular beam epitaxy (MBE). For the first time single crystal Ge (1-x) Sn(x) alloys were grown on lattice matched gallium antimonide (with x=0.5) and indium phosphides substrates up to a thickness of 0.3 micrometer. Reflection high energy electron diffraction (RHEED) observations and x ray measurements show that even at very small lattice mismatch, single crystal Ge(1-x)Sn(x) films cannot be grown thicker than 0.3 microns. The x ray results suggest that the critical thickness of alpha-Sn and Ge(1-x)Sn(x) single crystal films is mainly determined by a phase transition mechanism, and the dislocation generation equivalent critical thickness is an overestimate. Under practical MBE growth conditions, it is very difficult to grow thick films, due to the sensitivity of the critical thickness to composition fluctuations. Under an exact lattice match between substrate and film, the critical film thickness is limited. GRA

N90-27539# Naval Surface Weapons Center, Silver Spring, MD.
A SILVER-BEARING, HIGH-TEMPERATURE, SUPERCONDUCTING (HTS) PAINT
William A. Ferrando 15 Feb. 1990 25 p
(AD-A221616; NSWC-TR-90-48) Avail: NTIS HC A03/MF A01 CSCL 20/3

A substantial set of device applications awaits development of a workable, durable, high-temperature superconducting (HTS) paint. Such a paint should be truly superconducting with its critical temperature T sub c greater than 77K. For most of these applications, a high critical current (J sub c) is not required, although probably desirable. A process is described which can be used to produce silver-bearing HTS paint coatings on many engineering materials. Preliminary tests have shown good adherence to several ceramics and the ability to meet the superconducting criteria. Moreover, the coatings withstand multiple thermal cycling and stability under laboratory ambient storage conditions for periods of at least several months. GRA

N90-27540# General Atomic Co., San Diego, CA.
HIGH TEMPERATURE CERAMIC SUPERCONDUCTORS Quarterly Progress Report No. 5, 1 Jan. - 31 Mar. 1990
A. Chen, K. C. Chen, D. M. Duggan, F. C. Montgomery, S. S. Pak, M. B. Maple, L. Paulius, and P. Tsai (California Univ., San Diego.) Mar. 1990 50 p
(Contract N00014-88-C-0714)
(AD-A221743; GA-C-19465) Avail: NTIS HC A03/MF A01 CSCL 11/2

The principal objectives of this program are to demonstrate fabrication of high-temperature ceramic superconductors that can operate at or above 90 K with appropriate current density, J(c), in forms useful for application in resonant cavities, magnets, motors, sensors, computers, and other devices; and to fabricate and demonstrate selected components made of these materials, including microwave cavities and magnetic shields. GRA

77 THERMODYNAMICS AND STATISTICAL PHYSICS

Includes quantum mechanics; theoretical physics; and Bose and Fermi statistics.

For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer.*

N90-27541# Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study.

BRS INVARIANT STOCHASTIC QUANTIZATION OF EINSTEIN GRAVITY

Naohito Nakazawa Nov. 1989 35 p

(DE90-791126; INS-798) Avail: NTIS (US Sales Only) HC A03

Stochastic quantization of gravity was studied in terms of a BRS invariant canonical operator formalism. By introducing artificially canonical momentum variables for the original field variables, a canonical formulation of stochastic quantization is proposed in the sense that the Fokker-Planck Hamiltonian is the generator of the fictitious time translation. Then is was shown that there exists a nilpotent BRS symmetry in an enlarged phase space of the first-class constrained systems. The phase space is spanned by the dynamical variables, their canonical conjugate momentum variables, Faddeev-Popov ghost and anti-ghost. The general BRS invariant formulation was applied to stochastic quantization of gravity which is described as a second-class constrained system in terms of a pair of Langevin equations coupled with white noises. It is shown that the stochastic action of gravity includes explicitly the De Witt's type superspace metric which leads to a geometrical interpretation of quantum gravity analogous to nonlinear sigma-models. DOE

N90-27542# California Inst. of Tech., Pasadena. Div. of Engineering and Applied Science.

A CONTINUUM MODEL FOR PHASE TRANSFORMATION IN THERMOELASTIC SOLIDS

Qing Jiang Jul. 1989 75 p

(Contract N00014-87-K-0117)

(AD-A222353; TR-9) Avail: NTIS HC A04/MF A01 CSCL 20/13

Under suitable programs of mechanical or thermal loading, many solid materials are capable of undergoing phase transformations from one crystal structure to another. The austenite-martensite transformation that occurs in a variety of metallic alloys, including the so-called shape memory materials, provides an example. The present paper represents an effort to model coupled thermomechanical effects in the macroscopic response of solids that arise from the occurrence of phase transformations. A Helmholtz free energy potential is constructed to describe the thermo mechanical response of the hypothetical material to be considered here. As a function of shear strain, the potential is non-convex in a certain range of temperature; this feature is essential for the modeling of phase transformations. Apart from some general preliminary considerations pertaining to finite thermoelasticity, the analysis is carried out in the context of a simple problem, idealized from an experiment, in which an annular cylinder is deformed to a state of radically symmetric, finite anti-plane shear in the presence of differing inner and outer surface temperatures. After constructing all radially symmetric weak solutions involving at most a single surface of discontinuity of strain or temperature gradient, we determine the implications for quasi-static motions of the second law of thermodynamics. GRA

80 SOCIAL SCIENCES (GENERAL)

Includes educational matters.

No abstracts in this category.

81 ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

N90-27543# Massachusetts Inst. of Tech., Cambridge. Lab. for Information and Decision Systems.

EFFECTS OF ORGANIZATIONAL STRUCTURE ON PERFORMANCE: EXPERIMENTAL RESULTS

Victoria Y. Jin and Alexander H. Levis May 1990 12 p

(Contracts N00014-85-K-0782; N00014-84-K-0519)

(AD-A222871; LIDS-P-1978) Avail: NTIS HC A03/MF A01 CSCL 12/4

A multi-person, model-driven experiment has been designed on the basis of a mathematical model of distributed tactical decision making. Two organizational structures are used in the investigation: a parallel one and a hierarchical one. The performance of the organization is measured in terms of its response time and accuracy. These two measures represent team performance. In addition, the cognitive workload of decision makers (DMs) during the execution of the task is estimated because bounded rationality imposes a limitation on the human's capability for processing information and making decision. The results show that interaction among DMs compensates for differences in individual performance characteristics. Individual differences have more influence on performance in the organization in which DMs have more autonomy in making decisions than in the organization in which individual decisions are coupled with the decisions of other organization members. When available decreases, time pressure is introduced in the organization and DMs have to adjust their processing rate. The experimental results confirm a hypothesis which predicts that with decreasing available time, a significant degradation of performance occurs first in the organization which has the highest minimum feasible workload. GRA

N90-27544# Defense Systems Management School, Fort Belvoir, VA.

SYSTEMS ENGINEERING MANAGEMENT GUIDE

F. Kockler, T. Withers, J. Poodiack, and M. Gierman Jan. 1990 295 p

(AD-A223168) Avail: NTIS HC A13/MF A02; SOD HC $15.00 as 008-020-01202-5 CSCL 05/1

This is one of a family of educational acquisition management guides written from a Department perspective; e.g., non-service peculiar. These are intended primarily for use in the courses offered by the Defense Systems Management College and secondarily as desk references for DoD Acquisition Managers. This family of guides consists of: (1) Integrated Logistics Support Guide; (2) Mission Critical Computer Resources Management Guide; (3) Test and Evaluation Management Guide; (4) Risk Management Concepts and Guidance; (5) DoD Manufacturing Management Handbook; and (6) Subcontracting Management Handbook. It is designed to: (1) acquaint the newcomer with systems engineering concepts and techniques, and (2) identify relevant directives and references. These concepts, when combined with common sense and technical expertise, constitute the basis of a sound systems engineering program. Highlights are the technical management activities over the system's life cycle from program initiation to system disposal. All activity centers around the system itself; thus, the system configuration at any time is of common interest to all engineering disciplines. These activities are normally divided into functional areas of design, test, manufacturing, and logistics support. Each of these functional areas is active throughout the system's life cycle. GRA

N90-27545# Air Force Office of Scientific Research, Bolling AFB, Washington, DC. Technical Documents Section.

RESEARCH PROPOSAL Quarterly Status Report, Jan. - Mar. 1990

Debra Tyrrell Apr. 1990 83 p LIMITED REPRODUCIBILITY: Availability: Document partially illegible

(AD-A221453; AFOSR-TR-90-0501) Avail: NTIS HC A05/MF A01 CSCL 05/1

This reports lists all the research proposals received by the Air Force Office of Scientific Research in the six month period prior to the date of this report. Normally, decisions and actions are made within six months after receiving a research proposal. The action taken (i.e., initiated, declined, or withdrawn) are listed in this report. Part 1 contains the Institution Index which lists the proposals received, alphabetically by institution. Part 2 is the AFOSR Directorate Index in which the proposals received are listed alphabetically by Directorate and alphabetically by AFOSR Program Manager within the Directorate. The purpose of the quarterly report is to inform other Government sponsoring agencies of the proposals received by the AFOSR and the action taken on these proposals. Users of the report should clearly understand that declined proposals should not necessarily be considered as scientifically unacceptable since many declinations result from a lack of funds or from special programmatic emphasis. GRA

N90-27546# Federal Aviation Administration, Atlantic City, NJ.
FEDERAL AVIATION ADMINISTRATION SMALL BUSINESS INNOVATION RESEARCH 5-YEAR PROJECT SUMMARIES
Final Report, 1985 - 1989
James H. Remer Feb. 1990 102 p
(AD-A221590; DOT/FAA/CT-90/5) Avail: NTIS HC A06/MF A01 CSCL 05/1

This document contains a summary of all Small Business Innovation Research (SBIR) Phase 1 and Phase 2 contract awards sponsored, either fully or on a shared cost basis, by the FAA. The research projects contained in this document provide information on each project, including company, principal investigator, contract number, period of performance, FAA technical monitor, and either a summary of the proposed research and anticipated results or a summary of the completed research. This document covers research conducted over a 5-year period from 1985 through 1989. GRA

N90-27278*# Alabama Univ., Huntsville. Artificial Intelligence Lab.
RESOURCE ALLOCATION USING CONSTRAINT PROPAGATION
John S. Rogers *In* NASA, Marshall Space Flight Center, Fifth Conference on Artificial Intelligence for Space Applications May 1990 p 19-24 (For primary document see N90-27275 21-61) Avail: NTIS HC A25/MF A04 CSCL 05A

82 DOCUMENTATION AND INFORMATION SCIENCE

Includes information management; information storage and retrieval technology; technical writing; graphic arts; and micrography.

For computer documentation see *61 Computer Programming and Software.*

N90-27547# Office of Technology Assessment, Washington, DC.
COPYRIGHT AND HOME COPYING: TECHNOLOGY CHALLENGES THE LAW
Oct. 1989 295 p
(PB90-151309; OTA-CIT-422; LC-89-600714) Avail: NTIS HC A13/MF A02; SOD HC $13.00 as 052-003-01169-7 CSCL 05B

Home recording technologies are examined. Then, focusing primarily on audiotaping, the ambiguous legal status of home copying is examined. The economic effects that home audiotaping may have on the recording industry, contrasted to the effects that restricting home taping might have on consumers, are considered. Finally, a range of actions that either Congress or the industry might pursue are identified. Included are the results of a national survey of home taping and copying behavior conducted in the autumn of 1988. In this survey, 1,500 members of the public responded to a range of questions about their own audio- and video-taping behaviors and their attitudes toward various policy approaches related to home taping. Author

N90-27548*# National Aeronautics and Space Administration, Washington, DC.
INFORMATION RESOURCES MANAGEMENT, 1984-1989: A BIBLIOGRAPHY WITH INDEXES
May 1990 202 p
(NASA-SP-7079; NAS 1.21:7079) Avail: NTIS HC A10 CSCL 05B

This bibliography contains 768 annotated references to reports and journal articles entered into the NASA scientific and technical information database 1984 to 1989. Author

N90-27549# Office of Technology Assessment, Washington, DC.
HELPING AMERICA COMPETE: THE ROLE OF FEDERAL SCIENTIFIC AND TECHNICAL INFORMATION
Jul. 1990 77 p
(OTA-CIT-454) Avail: NTIS HC A05/MF A01; also available SOD HC $3.75 as 052-003-01196-4

The U.S. Government spends 65 billion dollars per year on research and development. A major product of this expenditure is scientific and technical information (STI) essential for understanding, identifying, and solving everyday health, transportation, climate change, product development, and other problems. STI is a prime ingredient of innovation and can help the U.S. maintain its leadership and stay competitive in world markets. An assessment is made of how STI can contribute to a more competitive America and what actions are needed to realize this potential. Recommendations include the establishment of Congressional information dissemination policies, improvements in education, more standards, and the creation and use of directories. J.P.S.

N90-27550# Lawrence Livermore National Lab., CA.
OMNI DEVELOPMENT OF AN ENGINEERING PRODUCT DATA MANAGEMENT SYSTEM
Ann S. Miranda (RIM Technology, Inc., Issaquah, WA.) and Timothy M. Locke 1989 28 p Presented at the ASME International Conference on Computers in Engineering, Boston, MA, 5-9 Aug. 1990
(Contract W-7405-eng-36)
(DE90-002407; LA-UR-89-3474; CONF-900837-1) Avail: NTIS HC A03/MF A01

The increasing use of computers in engineering design and manufacturing (CAD/CAM) has been accompanied by the need to effectively manage the data produced, and the applications that produce the data. An integrated engineering product data management system (PDMS) called OMNI is presented. OMNI manages the product data, and controls access to the various CAD/CAM applications used to produce engineering data. OMNI is based on a relational data base (RTIRIM) and a FORTRAN interface between the data base, the operating system, and the engineering application programs. DOE

N90-27551# California Univ., Berkeley. Lawrence Berkeley Lab.
REPRESENTING PROCESSES IN THE EXTENDED ENTITY-RELATIONSHIP MODEL
Victor M. Markowitz Feb. 1990 8 p Presented at the 6th International Conference on Data Engineering, Los Angeles, CA, 5-9 Feb 1990
(Contract DE-AC03-76SF-00098)
(DE90-013350; LBL-27198; CONF-900214-3) Avail: NTIS HC A02/MF A01

Although closely related, functional and structural aspects of information systems are modeled usually independently of each other. Functional and structural modeling are combined into an integrated design methodology. For this purpose two popular and widely used models, the Data-Flow oriented functional model and the Extended Entity-Relationship (EER) data model were choosen. Since functional modeling generally precedes structural modeling

the design of information systems, how functional specifications can be represented using EER construct is examined. The methodology is based on using EER existence dependencies for representing the functional constraints implied by the process interactions. DOE

N90-27552*# Control Data Corp., Alexandria, VA.
THE NATO THESAURUS PROJECT
Jonathan Krueger May 1990 29 p Sponsored in part by NASA, Washington and AF, Washington, DC
(Contract MDA903-88-C-0186)
(NASA-CR-186931; NAS 1.26:186931; AD-A222700; USAF-STINFO-CONTRIB-90/3; SAF/AQT-SR-90-007) Avail: NTIS HC A03/MF A01 CSCL 05/2

This document describes functionality to be developed to support the NATO technical thesaurus. Described are the specificity of the thesaurus structure and function; the distinction between the thesaurus information and its representation in a given online, machine readable, or printed form; the enhancement of the thesaurus with the assignment of COSATI codes (fields and groups) to posting terms, the integration of DTIC DRIT and NASA thesauri related terminology, translation of posting terms into French; and the provision of a basis for system design. GRA

N90-27553*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
THE ROLE OF THE US GOVERNMENT TECHNICAL REPORT IN AERONAUTICS: AN EXPLORATORY STUDY Ph.D. Thesis - Indiana Univ.
Thomas E. Pinelli Aug. 1988 111 p Sponsored in part by AF, Washington, DC
(NASA-TM-893470; NAS 1.15:893470; AD-A222955; USAF-STINFO-CONTRIB-90/4; SAF/AQT-SR-90-008) Avail: NTIS HC A06/MF A01 CSCL 05/2

The purpose is to explore the production, transfer, and use of scientific and technical information (STI) by aeronautical engineers and scientists for the purpose of determining the role of the U.S. government technical report in aeronautics. A secondary purpose is the creation of a knowledge base regarding the handling and use of STI by the same community. Elements are: to determine the extent to which the purpose for which information is used and the information source selection is influenced; to determine the extent to which the selection of an information source is influenced by the factors of accessibility, expense, relevance, timeliness, and comprehensiveness; to identify the attitudes of aeronautical engineers and scientists toward information technology; to identify the attitudes toward scientific and technical libraries; to determine the extent to which there may be discontinuity between the Federal systems that handle STI and the aeronautical community to whom the STI is directed. Author

N90-27554# Defence Research Establishment Suffield, Ralston (Alberta).
AUTHORS GUIDE TO THE PUBLISHING PROCEDURES AT DEFENCE RESEARCH ESTABLISHMENT SUFFIELD
J. G. Currie and A. M. Dickason Apr. 1990 35 p
(AD-A223101; DRES-SP-132) Avail: NTIS HC A03/MF A01 CSCL 05/2

The publishing procedures at the Defence Research Establishment Suffield are presented for the purpose of facilitating the process for authors. The categories of papers are defined, the spheres of responsibility are outlined, the role of the Document Review Panel is explained and the steps for filling out the forms for each publication category are shown. GRA

N90-27555# Institute for Defense Analyses, Alexandria, VA.
INTERIM STATUS AND RECOMMENDATIONS FOR THE ENGINEERING INFORMATION SYSTEM (EIS) PROGRAM Final Report
Robert M. Rolfe, Dennis W. Fife, Edgar H. Sibley, and Herbert R. Brown Mar. 1990 48 p
(Contract MDA903-89-C-0003)
(AD-A222060; AD-E501230; IDA-D-693; IDA/HQ-90-035378)
Avail: NTIS HC A03/MF A01 CSCL 05/2

IDA Document D-693, Interim Status and Recommendations for the Engineering Information System (EIS) Program, provides an analysis of the Engineering Information System (EIS) framework performed by the Institute for Defense Analysis (IDA). IDA evaluated the present work on the EIS, made recommendations for the improving the effectiveness of EIS products, and identified the needed tasks and future considerations. This document is the result of tracking the program implementation, starting with the original requirements and progressing through in-process documents produced for the EIS program, and discussions from meetings and workshops with the EIS contractors and Advisory Committees. GRA

N90-27556# Surveillance Research Lab., Salisbury (Australia).
STATUS REPORT ON IMAGE INFORMATION SYSTEMS AND IMAGE DATA BASE TECHNOLOGY
M. J. Fiebig Dec. 1989 66 p
(AD-A221488; SRL-0047-TM; DODA-AR-005-968) Avail: NTIS HC A04/MF A01 CSCL 12/5

The contents of this report form part of a study to determine guideline's for the establishment of databases containing digital imagery and ancillary information. It begins with an introduction to the basic concepts of databases. This provides the background to the terminology commonly used in this report and other related literature. A review of current commercially available database systems is made, drawing principally on a market study conducted in mid 1989. Of specific interest is the extent to which image databases are being utilized and the applications which use digital imagery (or pictures) in database management systems (DBMS). Finally, there is an overview of image compression techniques, considering the current trends and future directions of the field. GRA

N90-27557# University Coll. of North Staffordshire, Keele (England). Dept. of Psychology.
FURTHER RESEARCH ON HEADING IN TEXT Final Technical Report, Jan. 1982 - Mar. 1984
James Hartley and Mark Trueman 28 Dec. 1989 53 p
(Contract DAJA5-83-C-0033; DA Proj. 2Q1-61102-B-74-F)
(AD-A221511) Avail: NTIS HC A04/MF A01 CSCL 05/2

This research presents the results of two experiments designed to complement the seven experiments reported earlier (The effects of heading in text). The present experiment examined the effects of different kinds of heading in different positions. The results indicated that headings aided recall, search and retrieval, but the kind and the position of the heading had no significant effect. A further three replication studies were then carried out, utilizing a different text, and a different population of readers. Headings were found to aid search and retrieval but not recall in these studies. Finally two more experiments are described which examined the effects of type o heading with lessable respondents. These experiments utilized both texts with the older age groups. There were no significant interactions between the kind of heading and the ability of the participants in either experiment. GRA

N90-27558# Massachusetts Inst. of Tech., Cambridge. Lab. for Information and Decision Systems.
ADVANCED RETRIEVAL ASSISTANCE FOR THE DGIS GATEWAY Final Report, Sep. 1989 - Mar. 1990
Richard S. Marcus Mar. 1990 41 p
(Contract MDA903-88-C-0186)
(AD-A221592; LIDS-R-1958; USAF-STINFO-CONTRIB-90/1; SAF/AQT-SR-90-005) Avail: NTIS HC A03/MF A01 CSCL 12/5

The objective was to further develop and test advanced retrieval assistance techniques within the experimental CONIT (Connector for Networked Information Transfer) testbed for possible incorporation into DGIS (DoD Gateway Information System). Significant results were achieved in three areas: (1) a partial implementation of an integrated, networkable X-Window interface, (2) implementation of the first phase of an algorithm that

automatically ranks documents according to precision/relevance models, and (3) recommendations for incorporating existing advanced techniques and further design of more powerful techniques. Also developed was the design and partial implementation of an automatic search strategy narrowing selector based on user feedback or reasons for document irrelevance.
GRA

N90-27559# Army Construction Engineering Research Lab., Champaign, IL.
INDEX OF USACERL PUBLICATIONS, OCTOBER 1984-DECEMBER 1989
Feb. 1990 168 p Supersedes report dated Feb. 1989, AD-A206642
(AD-A221644) Avail: NTIS HC A08/MF A01 CSCL 13/2

This index lists reports published by the USA Construction Engineering Research Laboratory (USACERL). It contains a report number index that lists complete bibliographic information on each report. It also contains author, subject, title, and AD Number indexes that are cross-referenced to the report number index. (An index to reports published by USACERL from the laboratory's inception in 1969 through September 1984 is available as ADA168728.) Reports are listed from the following divisions: Energy Systems Div.; Engineering and Materials Div.; Environmental Div.; Facility Systems Div.; and Repair, Evaluation, Maintenance, and Rehabilitation Research Program.
GRA

N90-27560# Naval Postgraduate School, Monterey, CA. Dept. of Administrative Sciences.
A DICTIONARY OF ACQUISITION AND CONTRACTING TERMS M.S. Thesis
Daniel Lee Downs Dec. 1989 93 p
(AD-A221681) Avail: NTIS HC A05/MF A01 CSCL 15/5

This thesis is a continuation of research initiated to establish a basis for defining words and terms used in the field of contracting. It offers a sample of published definitions presently used in government contracting. A synthesis of different published definitions was produced and the results sent to recognized professionals in the contracting discipline for their opinion. Their feedback was used to arrive at an acceptable definition of the words and terms offered. Concurrent research in this area is being conducted by students at the Naval Postgraduate School, Monterey, California and the Air Force Institute of Technology, Wright-Patterson Air Force Base, Dayton, Ohio. Follow-on work needs to be done to define other words and terms in the contracting field using the procedure established by LCDR Ryan. The 25 contracting terms for which consensual definitions were established are presented.
GRA

N90-27151*# College of William and Mary, Williamsburg, VA. Dept. of Computer Sciences.
DATA ANALYSIS TECHNIQUES
Steve Park *In* NASA, Langley Research Center, Earth Sciences Requirements for the Information Sciences for Experiment System Jul. 1990 p 115-122 (For primary document see N90-27140 21-43)
Avail: NTIS HC A10/MF A02 CSCL 05B

N90-27318*# University of Central Michigan, Mount Pleasant. Dept. of Computer Engineering.
AUTOMATED EXTRACTION OF KNOWLEDGE FOR MODEL-BASED DIAGNOSTICS
Avelino J. Gonzalez, Harley R. Myler, Massood Towhidnejad, Frederic D. McKenzie, and Robin R. Kladke *In* NASA, Marshall Space Flight Center, Fifth Conference on Artificial Intelligence for Space Applications May 1990 p 393-401 (For primary document see N90-27275 21-61)
(Grant NAG10-0043)
Avail: NTIS HC A25/MF A04 CSCL 05B

N90-27325*# Alabama Univ., Huntsville. Dept. of Computer Science.
DOCUMENTATION AND KNOWLEDGE ACQUISITION
Daniel Rochowiak and Warren Moseley *In* NASA, Marshall Space Flight Center, Fifth Conference on Artificial Intelligence for Space Applications May 1990 p 477-486 (For primary document see N90-27275 21-61)
(Contract NAS8-36955)
Avail: NTIS HC A25/MF A04 CSCL 05B

N90-27326*# University of Western Kentucky, Bowling Green. Dept. of Computer Science.
INDUCTIVE KNOWLEDGE ACQUISITION EXPERIENCE WITH COMMERCIAL TOOLS FOR SPACE SHUTTLE MAIN ENGINE TESTING
Kenneth L. Modesitt *In* NASA, Marshall Space Flight Center, Fifth Conference on Artificial Intelligence for Space Applications May 1990 p 487-496 (For primary document see N90-27275 21-61)
Avail: NTIS HC A25/MF A04 CSCL 05B

N90-27329*# Martin Marietta Corp., New Orleans, LA. Manned Space Systems Div.
DEB: A DIAGNOSTIC EXPERIENCE BROWSER USING SIMILARITY NETWORKS
Cyprian E. Casadaban *In* NASA, Marshall Space Flight Center, Fifth Conference on Artificial Intelligence for Space Applications May 1990 p 517-524 (For primary document see N90-27275 21-61)
Avail: NTIS HC A25/MF A04 CSCL 05B

N90-27330*# Alabama Univ., Huntsville. Dept. of Computer Science.
ARTIFICIAL INTELLIGENCE TECHNIQUES FOR MODELING DATABASE USER BEHAVIOR
Steve Tanner and Sara J. Graves *In* NASA, Marshall Space Flight Center, Fifth Conference on Artificial Intelligence for Space Applications May 1990 p 525-534 (For primary document see N90-27275 21-61)
Avail: NTIS HC A25/MF A04 CSCL 05B

83 ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

No abstracts in this category.

84 LAW, POLITICAL SCIENCE AND SPACE POLICY

Includes NASA appropriation hearings; aviation law; space law and policy; international law; international cooperation; and patent policy.

N90-27561# Committee on Appropriations (U.S. House).
DEPARTMENTS OF VETERANS AFFAIRS AND HOUSING AND URBAN DEVELOPMENT, AND INDEPENDENT AGENCIES APPROPRIATIONS FOR 1991. PART 4: NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
GPO 1990 1319 p Hearings before the Committee on Appropriations, 101st Congress, 2nd Session, 20 Mar. 1990
(GPO-30-861) Avail: Subcommittee on VA, HUD, and Independent Agencies, House of Representatives, Washington, DC 20510 HC free; also available SOD HC $31.00 as 552-070-08441-0

Hearings before a subcommittee of the House Committee on Appropriations are presented along with the budget estimates for the National Aeronautics and Space Administration for the fiscal year 1991. All written testimony and submittals for the record are also included. The budget estimates provide a detailed outline of budgetary information and justification for research and

development, for construction of facilities, and for research and program management. J.P.S.

85 URBAN TECHNOLOGY AND TRANSPORTATION

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.

For related information see also *03 Air Transportation and Safety, 16 Space Transportation,* and *44 Energy Production and Conversion.*

No abstracts in this category.

88 SPACE SCIENCES (GENERAL)

N90-27562*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.
CARBON IN THE GALAXY: STUDIES FROM EARTH AND SPACE
Jill C. Tarter, ed., Sherwood Chang, ed., and Doug J. DeFrees, ed. (Molecular Research Inst., Palo Alto, CA.) Washington Apr. 1990 350 p Meeting held at Moffett Field, CA, 5-6 Nov. 1987 (NASA-CP-3061; A-90031; NAS 1.55:3061) Avail: NTIS HC A15/MF A02 CSCL 03B

Presented here is the text of the invited papers presented during a meeting entitled, Carbon in the Galaxy: Studies from Earth and Space, that was held at NASA Ames Research Center on November 5 and 6, 1987. For completeness, abstracts from all of the poster papers and the text of a paper summarizing what was learned during the course of the meeting are also included. The underlying premise for the meeting was that there is much to be gained by bringing together scientists from very different disciplines, all of whom study carbon in different ways for different reasons. The interchanges took place during the meeting and the contents of the enclosed papers validate that premise. For individual titles, see N90-27563 through N90-27593.

N90-27563*# California Univ., Los Angeles.
CARBON IN PRIMITIVE METEORITES **c90**
John F. Kerridge *In* NASA, Ames Research Center, Carbon in the Galaxy: Studies from Earth and Space Apr. 1990 p 3-20 (For primary document see N90-27562 21-88)
Avail: NTIS HC A15/MF A02 CSCL 03B

No meteorites are truly primitive, in the sense of being pristine collections of interstellar grains or solar-nebular condensates. Nonetheless, some chrondritic meteorites have been so little altered by secondary processing that they are commonly termed primitive and it is almost a definition of such chondrites that they contain significant quantities of carbon. Most of that carbon is of apparently local, i.e., solar-system, origin but a proportion that ranges from trace, in some cases, to minor, in others, is believed to be exotic, i.e., of circumstellar or interstellar origin, and it is upon such material that researchers focus here. The nature of the meteoritic samples and the techniques used to analyse them are briefly discussed and the observational record is surveyed. Clearly, the study of exotic carbon preserved in meteorites has been informative about sites of nucleosynthesis, processes of nucleation and growth of grains in stellar outflows, grain survival in the interstellar medium, and many other topics of astrophysical significance. Much more work, particularly of an interdisciplinary nature remains to be done, however. Author

N90-27564*# Washington Univ., Seattle.
CARBON IN COMET DUST **c90**
D. E. Brownlee *In* NASA, Ames Research Center, Carbon in the Galaxy: Studies from Earth and Space Apr. 1990 p 21-25 (For primary document see N90-27562 21-88)
Avail: NTIS HC A15/MF A02 CSCL 03B

The association of Halley particle results with data from existing meteoritic materials that can be analyzed in the laboratory is discussed. Comet samples must exist in present collections of meteoritic materials and the Halley results provide clues for identifying them. Although it is not presently possible to positively identify cometary meteorites or cometary interplanetary dust (IDP) samples, it is possible to determine which materials are similar to Halley dust and which ones are distinctly unlike Halley. The properties of these existing Halley-compatible samples provide insight into the possible properties of cometary material. Positive identification of meteoritic comet samples or direct samples returned from a comet nucleus would of course revolutionize our ability to study carbonaceous matter in comets. Modern analytical techniques are very powerful and it is possible to perform elemental, chemical, mineralogical and even limited isotopic analysis on micron-size particles. There is an important synergism between the laboratory studies of collected samples and astronomical data from comets and interstellar grains. To fully interpret results there must be convincing methods for associating a particular class or classes of meteoritic material with comets. Ultimately this will be done by direct comet sample return such as the Rosetta mission under development by ESA. At the present time the only links that can be made involve comparison with sample properties and measurable properties of comets. Unfortunately there is at present no known unique property of cometary dust that allows its absolute identification in the laboratory. The results from Halley encounters and observation do provide much new information on cometary grains. The Halley grain compositions, density, size distribution and scattering properties all provide a basis for future investigations. Other Halley properties such as the presence of polyoxymethylene and the 3.4um emission feature could play key roles for making convincing links in the future. Author

N90-27565*# Martin Marietta Aerospace, Denver, CO.
CARBON-RICH PARTICLES IN COMET HALLEY **c90**
Benton C. Clark *In* NASA, Ames Research Center, Carbon in the Galaxy: Studies from Earth and Space Apr. 1990 p 27-36 (For primary document see N90-27562 21-88)
(Contract JPL-956214)
Avail: NTIS HC A15/MF A02 CSCL 03B

The majority of particles detected in the coma of Comet Halley contain carbon atoms; many of these grains appear to consist preponderately or only of light elements. These light-element particles may be composed of organic compounds. Of the possible combinations of the elements hydrogen, carbon, nitrogen, and oxygen, numerous examples are found of particles containing the combinations (H,C,O,N), (H,C,N), (H,C,O), and (H,C). These results may bear on the recent detection of polyoxymethylene fragments, the observation of cyanojets (CN patterns consistent with release from solid particles), the possible presence of cyanopolyacetylenes or HCN polymer and the make-up of the CHON particles. If cometary matter could reach the surface of the earth without complete disruption, these diverse organic and mixed particles could create unique microenvironments, possibly with significant or even pivotal prebiotic chemical activity. Here a speculative insight into possible relationships between carbon in comets and carbon in life is given, as well as a brief overview of on-going analysis of data from the highly successful Particle Impact Analyzer (PIA) experiment flown on the Giotto spacecraft for the flyby of Comet Halley (development and implementation of PIA was under the direction of J. Kissel of the Max Planck Institute for Kernphysik, Heidelberg). PIA is a time-of-flight analyzer which obtains mass spectra of ions from individual particles impacting on a Pt-Ag foil target within the instrument. Author

N90-27566*# California Univ., Los Angeles.
ASTRONOMICAL OBSERVATIONS OF SOLID PHASE CARBON **c89**
M. Jura *In* NASA, Ames Research Center, Carbon in the Galaxy:

Studies from Earth and Space Apr. 1990 p 39-45 (For primary document see N90-27562 21-88)
Avail: NTIS HC A15/MF A02 CSCL 03A

In the outer envelopes of red giants, when the gas cools sufficiently, molecules and solids form. Thermodynamically, the most stable molecule is CO, and it is usually assumed that all the available carbon and oxygen are consumed in the formation of this molecule (Salpeter 1977). If the carbon abundance is greater than the oxygen abundance, then the carbon left over after the formation of CO is available for solid grains. Because carbon is by far the most abundant species available for making solids in these environments, researchers anticipate that the grains are composed of nearly pure carbon in some form. The observations which can be used to infer the nature of this solid phase carbon are discussed. The observations of the dust around carbon-rich red giants are discussed. These results are then placed into their broader astrophysical context. Author

N90-27567*# New Orleans Univ., LA. Dept. of Physics.
SURVIVAL OF CARBON GRAINS IN SHOCKS **c90**
C. Gregory Seab *In* NASA, Ames Research Center, Carbon in the Galaxy: Studies from Earth and Space Apr. 1990 p 47-58 (For primary document see N90-27562 21-88)
Avail: NTIS HC A15/MF A02 CSCL 03B

Supernova shocks play a significant part in the life of an interstellar grain. In a typical 10 to the 9th power year lifetime, a grain will be hit by an average of 10 shocks of 100 km s(sup -1) or greater velocity, and even more shocks of lower velocity. Evaluation of the results of this frequent shock processing is complicated by a number of uncertainties, but seems to give about 10 percent destruction of silicate grains and about half that for graphite grains. Because of the frequency of shocking, the mineralogy and sizes of the grain population is predominately determined by shock processing effects, and not by the initial grain nucleation and growth environment. One consequence of the significant role played by interstellar shocks is that a certain fraction (up to 5 percent) of the carbon should be transformed into the diamond phase. Diamond transformation is observed in the laboratory at threshold shock pressures easily obtainable in grain-grain collisions in supernova shocks. Yields for transforming graphite, amorphous carbon, glassy carbon, and other nearly pure carbon solids into diamond are quite high. Impurities up to at least the 10 percent level (for oxygen) are tolerated in the process. The typical size diamond expected from shock transformation agrees well with the observed sizes in the Lewis et al. findings in meteoritic material. Isotropic anomalies already contained in the grain are likely to be retained through the conversion process, while others may be implanted by the shock if the grain is close to the supernova. The meteoritic diamonds are likely to be the results of transformation of carbon grains in grain-grain collisions in supernova shock waves. Author

N90-27568*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.
CARBON STARDUST: FROM SOOT TO DIAMONDS **c90**
A. G. G. M. Tielens *In its* Carbon in the Galaxy: Studies from Earth and Space Apr. 1990 p 59-111 Prepared in cooperation with California Univ., Berkeley (For primary document see N90-27562 21-88)
Avail: NTIS HC A15/MF A02 CSCL 03B

The formation of carbon dust in the outflow from stars and the subsequent evolution of this so called stardust in the interstellar medium is reviewed. The chemical and physical processes that play a role in carbon stardust formation are very similar to those occurring in sooting flames. Based upon extensive laboratory studies of the latter, the structure and physical and chemical properties of carbon soot are reviewed and possible chemical pathways towards carbon stardust are discussed. Grain-grain collisions behind strong interstellar shocks provide the high pressures required to transform graphite and amorphous carbon grains into diamond. This process is examined and the properties of shock-synthesized diamonds are reviewed. Finally, the interrelationship between carbon stardust and carbonaceous meteorites is briefly discussed. Author

N90-27569*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.
INTERSTELLAR GRAIN CHEMISTRY AND ORGANIC MOLECULES **c90**
L. J. Allamandola and S. A. Sandford *In its* Carbon in the Galaxy: Studies from Earth and Space Apr. 1990 p 113-146 (For primary document see N90-27562 21-88)
Avail: NTIS HC A15/MF A02 CSCL 03B

The detection of prominant infrared absorption bands at 3250, 2170, 2138, 1670 and 1470 cm(-1) (3.08, 4.61, 4.677, 5.99 and 6.80 micron m) associated with molecular clouds show that mixed molecular (icy) grain mantles are an important component of the interstellar dust in the dense interstellar medium. These ices, which contain many organic molecules, may also be the production site of the more complex organic grain manties detected in the diffuse interstellar medium. Theoretical calculations employing gas phase as well as grain surface reactions predict that the ices should be dominated only by the simple molecules H2O, H2CO, N2, CO, O2, NH3, CH4, possibly CH3OH, and their deuterated counterparts. However, spectroscopic observations in the 2500 to 1250 cm(-1)(4 to 8 micron m) range show substantial variation from source reactions alone. By comparing these astronomical spectra with the spectra of laboratory-produced analogs of interstellar ices. one can determine the composition and abundance of the materials frozen on the grains in dense clouds. Experiments are described in which the chemical evolution of an interstellar ice analog is determined during irradiation and subsequent warm-up. Particular attention is paid to the types of moderately complex organic materials produced during these experiments which are likely to be present in interstellar grains and cometary ices. Author

N90-27570*# California Univ., Berkeley.
CARBON CHEMISTRY OF CIRCUMSTELLAR ENVELOPES **c90**
John H. Bieging *In* NASA, Ames Research Center, Carbon in the Galaxy: Studies from Earth and Space Apr. 1990 p 147-157 (For primary document see N90-27562 21-88)
Avail: NTIS HC A15/MF A02 CSCL 03B

The chemical composition of envelopes surrounding cool evolved stars, as determined from microwave spectroscopic observations, is reviewed. Emphasis is placed on recent observations with the new large mm-wavelength telescopes and interferometer arrays, and on new theoretical work, especially concerning ion-molecule chemistry of carbon-bearing in these envelopes. Thermal (as opposed to maser) emission lines are discussed. Much progress has been made in the past few years in the theoretical understanding of these objects. It is already clear, however, that observations with the new generation of mm-telescopes will require substantial improvements in the theoretical models to achieve a thorough understanding of the data now becoming available. Author

N90-27571*# California Inst. of Tech., Pasadena. Div. of Geological and Planetary Sciences.
CARBON CHEMISTRY IN DENSE MOLECULAR CLOUDS: THEORY AND OBSERVATIONAL CONSTRAINTS **c90**
Geoffrey A. Blake *In* NASA, Ames Research Center, Carbon in the Galaxy: Studies from Earth and Space Apr. 1990 p 159-179 (For primary document see N90-27562 21-88)
Avail: NTIS HC A15/MF A02 CSCL 03B

For the most part, gas phase models of the chemistry of dense molecular clouds predict the abundances of simple species rather well. However, for larger molecules and even for small systems rich in carbon these models often fail spectacularly. Researchers present a brief review of the basic assumptions and results of large scale modeling of the carbon chemistry in dense molecular clouds. Particular attention is to the influence of the gas phase C/O ratio in molecular clouds, and the likely role grains play in maintaining this ratio as clouds evolve from initially diffuse objects to denser cores with associated stellar and planetary

formation. Recent spectral line surveys at centimeter and millimeter wavelengths along with selected observations in the submillimeter have now produced an accurate inventory of the gas phase carbon budget in several different types of molecular clouds, though gaps in our knowledge clearly remain. The constraints these observations place on theoretical models of interstellar chemistry can be used to gain insights into why the models fail, and show also which neglected processes must be included in more complete analyses. Looking toward the future, larger molecules are especially difficult to study both experimentally and theoretically in such dense, cold regions, and some new methods are therefore outlined which may ultimately push the detectability of small carbon chains and rings to much heavier species. Author

N90-27572*# California Inst. of Tech., Pasadena.
CI, CII, AND CO AS TRACERS OF GAS PHASE CARBON c90
Jocelyn Keene *In* NASA, Ames Research Center, Carbon in the Galaxy: Studies from Earth and Space Apr. 1990 p 181-196 (For primary document see N90-27562 21-88)
Avail: NTIS HC A15/MF A02 CSCL 03B

In the dense interstellar medium, we find that about 20 percent of the total carbon abundance is in the form of CO, about 3 percent in C(sub I), and 100 percent in C(sub II) with uncertainties of factors of order 2. The abundance of other forms of gaseous carbon is negligible. CO is widespread throughout molecular clouds as is C(sub I). C(sub II) has only been observed near bright star-formation regions so far because of its high excitation energy. Further from ultraviolet sources it may be less abundant. Altogether we have accounted for about 1/3 of the total carbon abundance associated with dense molecular clouds. Since the other gaseous forms are thought to have negligible abundances, the rest of the carbon is probably in solid form. Author

N90-27573*# Rice Univ., Houston, TX.
DOWN-TO-EARTH STUDIES OF CARBON CLUSTERS c90
R. E. Smalley *In* NASA, Ames Research Center, Carbon in the Galaxy: Studies from Earth and Space Apr. 1990 p 199-244 Sponsored in part by NSF and by the Robert A. Welch Foundation (For primary document see N90-27562 21-88)
Avail: NTIS HC A15/MF A02 CSCL 03B

Recent advances in supersonic beam experiments with laser-vaporization sources of clusters have provided some interesting new insights into the nature of the small clusters of carbon, and the processes through which carbon condenses. One cluster in particular, C(sub 60), appears to play a central role. It is argued that this cluster takes the shape of a soccerball: a hollow sphere composed of a shell of 60 carbon atoms connected by a lattice of hexagonal and pentagonal rings, in a pattern of overall icosahedral symmetry. Although C(sub 60) appears to be uniquely stable due to its perfect symmetry, all other even-numbered carbon clusters in the 32 to 100+ atom size range seem to favor similar closed spheroidal forms. These species are interpreted as relatively unreactive side products in condensation reactions of carbon vapor involving spiraling graphitic sheets. The prevalence of C(sub 60) in laser-vaporized carbon vapors and sooting flames suggests that it may be formed readily whenever carbon condenses. Such ready formation and extraordinary stability may have substantial astrophysical implications. Author

N90-27574*# Minnesota Univ., Minneapolis. Supercomputer Inst.
ELECTRONIC AND MOLECULAR STRUCTURE OF CARBON GRAINS c90
Jan Almloef and Hans-Peter Luethi *In* NASA, Ames Research Center, Carbon in the Galaxy: Studies from Earth and Space Apr. 1990 p 245-258 (For primary document see N90-27562 21-88)
(Grant NSF CHE-86-10809)
Avail: NTIS HC A15/MF A02 CSCL 03B

Clusters of carbon atoms have been studied with large-scale ab initio calculations. Planar, single-sheet graphite fragments with 6 to 54 atoms were investigated, as well as the spherical C(sub 60) Buckminsterfullerene molecule. Polycyclic aromatic hydrocarbons (PAHs) have also been considered. Thermodynamic differences between diamond- and graphite-like grains have been studied in particular. Saturation of the peripheral bonds with hydrogen is found to provide a smooth and uniform convergence of the properties with increasing cluster size. For the graphite-like clusters the convergence to bulk values is much slower than for the three-dimensional complexes. Author

N90-27575*# Pennsylvania State Univ., University Park.
A UNIFYING PICTURE OF GAS-PHASE FORMATION AND GROWTH OF PAH (POLYCYCLIC AROMATIC HYDROCARBONS), SOOT, DIAMOND AND GRAPHITE c90
Michael Frenklach *In* NASA, Ames Research Center, Carbon in the Galaxy: Studies from Earth and Space Apr. 1990 p 259-273 Sponsored in part by NASA, Lewis Research Center and by ONR (For primary document see N90-27562 21-88)
Avail: NTIS HC A15/MF A02 CSCL 03B

A variety of seemingly different carbon formation processes -- polycyclic aromatic hydrocarbons and diamond in the interstellar medium, soot in hydrocarbon flames, graphite and diamond in plasma-assisted-chemical vapor deposition reactors -- may all have closely related underlying chemical reaction mechanisms. Two distinct mechanisms for gas-phase carbon growth are discussed. At high temperatures it proceeds via the formation of carbon clusters. At lower temperatures it follows a polymerization-type kinetic sequence of chemical reactions of acetylene addition to a radical, and reactivation of the resultant species through H-abstraction by a hydrogen atom. Author

N90-27576*# Sussex Univ., Brighton (England). School of Chemistry and Molecular Sciences.
THE FORMATION AND STRUCTURE OF CIRCUMSTELLAR AND INTERSTELLAR DUST c90
H. W. Kroto *In* NASA, Ames Research Center, Carbon in the Galaxy: Studies from Earth and Space Apr. 1990 p 275-284 (For primary document see N90-27562 21-88)
Avail: NTIS HC A15/MF A02 CSCL 03B

The intriguing abundance of long linear carbon chain molecules in some dark clouds and in circumstellar shells is still not well understood. Recent laboratory studies which have probed this problem indicate that when carbon vapor nucleates to form particles, linear chains and hollow cage molecules (fullerenes) also form at more-or-less the same time. The results have consequences for the formation, structures and spectroscopic properties of the molecular and dust components ejected from cool carbon-rich stars. A most interesting result of the experimental observations relates to the probability that a third character in addition to the chains and grains, the C(sub 60) molecule probably in the form of the ion C(sub 60)(sup +) in the less shielded regions, is present and perhaps responsible for some of the ubiquitously observed interstellar spectroscopic features such as the Diffuse Interstellar Features, the 2170A UV Absorption or perhaps some of the Unidentified Infrared Bands. Further study of small carbon particles which form in the gas phase has resulted in the discovery that they have quasi-icosahedral spiral shell structures. The role that such species may play in the interstellar medium as well as that played by C(sub 60) (or C sub 60 sup +) should soon be accessible to verification by a combination of laboratory experiment and astronomical spectroscopy. Author

N90-27577*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.
SIRTF: PROBING THE DARK CORNERS OF THE GALAXY c89
Michael W. Werner and Dora S. Willoughby (Information Management International, Inc., Palo Alto, CA.) *In its* Carbon in the Galaxy: Studies from Earth and Space Apr. 1990 p 287-302 (For primary document see N90-27562 21-88)
Avail: NTIS HC A15/MF A02 CSCL 03A

The Space Infrared Telescope Facility (SIRTF) is planned for launch by NASA in the mid-1990's. It will be a cryogenically-cooled observatory for infrared astronomy and will carry several focal plane instruments which will provide a wide range of imaging,

photometric, and spectroscopic capabilities. SIRTF will build on the scientific and technical progress of the successful IRAS mission and take the next step in the exploration of the Universe at infrared wavelengths. Most of the observing time during the five-to-ten year SIRTF mission will be available to General Investigators, so there will be ample opportunities for the pursuit of problems originating from within the Space Life Sciences community. Here, a review is given of the capabilities of SIRTF for this style of investigation, using the study of carbon in the Galaxy as a specific example. The very high sensitivity of SIRTF's spectrometers to diffuse emission will allow studies of carbon in both the gaseous and solid phase in the interstellar medium and should be of particular importance for the identification of the carbon-bearing macromolecules believed to be responsible for the emission features identified in the near infrared. SIRTF will also carry out studies of a wide variety of evolved stars which are returning gas and solid phase carbon to the interstellar medium and contribute to our understanding of the carbon budget in the Galaxy. These studies in the area of galactic astronomy will be complemented by detailed investigations of carbon-bearing compounds in solar system objects, including the surfaces of distant asteroids and cometary nuclei which are too faint to be studied in any other way. Author

N90-27578*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.
RESEARCH OPPORTUNITIES ON THE SPACE STATION
Guy Fogleman *In its* Carbon in the Galaxy: Studies from Earth and Space Apr. 1990 p 303-308 (For primary document see N90-27562 21-88)
Avail: NTIS HC A15/MF A02 CSCL 03B

Two interdisciplinary facilities that have been proposed for the Space Station, the Gas-Grain Simulation Facility and the Cosmic Dust Collector Facility, are reviewed. Both of these facilities provide opportunities for scientists interested in carbon related research to perform experiments in earth orbit. Author

N90-27579*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.
THE POSSIBLE PRESENCE OF INTERSTELLAR PAHs IN METEORITES AND INTERPLANETARY DUST PARTICLES Abstract Only **c90**
L. J. Allamandola, S. A. Sandford, and B. Wopenka (Washington Univ., Saint Louis, MO.) *In its* Carbon in the Galaxy: Studies from Earth and Space Apr. 1990 p 319-320 (For primary document see N90-27562 21-88)
Avail: NTIS HC A15/MF A02 CSCL 03B

The Raman spectra of interplanetary dust particles (IDPs) collected in the stratosphere show two bands at about 1350 and 1600 delta cm(-1) and a broader feature between 2200 and 3300 delta cm(-1) that are characteristic of aromatic molecular units with ordered domains smaller than 25A in diameter. This suggests that the carbonaceous material in IDPs may be similar to the polymeric component seen in meteorites, where this material is thought to consist of aromatic molecular units that are randomly inter-linked by short aliphatic bridges. The features in the Raman spectra of IDPs are similar in position and relative strength to interstellar infrared emission features that have been attributed to vibrational transitions in free molecular polycyclic aromatic hydrocarbons (PAHs). The Raman spectra of some IDPs also showed photoluminescence that is similar to the excess red emission from some astronomical objects and that has also been attributed to PAHs and PAH-related materials. Moreover, a part of the carbonaceous phase in IDPs contains deuterium to hydrogen ratios that are far greater than those found in terrestrial samples. Deuterium enrichment is expected in small free PAHs that are exposed to ultraviolet radiation in the interstellar medium. Taken together, these observations suggest that some fraction of the carbonaceous material in IDPs may have been produced in circumstellar dust shells and only slightly modified in interstellar space. Since many, if not most, IDPs come from comets, this supports the view that cometary material contains primitive components which can provide clues about early solar system (and perhaps even interstellar and circumstellar) processes. Author

N90-27580*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.
LABORATORY SIMULATION OF INTERSTELLAR GRAIN CHEMISTRY AND THE PRODUCTION OF COMPLEX ORGANIC MOLECULES Abstract Only **c90**
L. J. Allamandola, S. A. Sandford, and G. J. Valero *In its* Carbon in the Galaxy: Studies from Earth and Space Apr. 1990 p 321-322 (For primary document see N90-27562 21-88)
Avail: NTIS HC A15/MF A02 CSCL 03B

During the past 15 years considerable progress in observational techniques has been achieved in the middle infrared (5000 to 500 cm(-1), 2 to 20 microns m), the spectral region most diagnostic of molecular vibrations. Spectra of many different astronomical infrared sources, some deeply embedded in dark molecular clouds, are now available. These spectra provide a powerful probe, not only for the identification of interstellar molecules in both the gas solid phases, but also of the physical and chemical conditions which prevail in these two very different domains. By comparing these astronomical spectra with the spectra of laboratory ices one can determine the composition and abundance of the icy materials frozen on the cold (10K) dust grains present in the interior of molecular clouds. These grains and their ice mantles may well be the building blocks from which comets are made. As an illustration of the processes which can take place as an ice is irradiated and subsequently warmed, researchers present the infrared spectra of the mixture H2O:CH3OH:CO:NH3:C6H14 (100:50:10:10:10). Apart from the last species, the ratio of these compounds is representative of the simplest ices found in interstellar clouds. The last component was incorporated into this particular experiment as a tracer of the behavior of a non-aromatic hydrocarbon. The change in the composition that results from ultraviolet photolysis of this ice mixture using a UV lamp to simulate the interstellar radiation field is shown. Photolysis produces CO, CO2, CH4, HCO, H2CO, as well as a family of moderately volatile hydrocarbons. Less volatile carbonaceous materials are also produced. The evolution of the infrared spectrum of the ice as the sample is warmed up to room temperature is illustrated. Researchers believe that the changes are similar to those which occur as ice is ejected from a comet and warmed up by solar radiation. The warm-up sequence shows that the nitrile or iso-nitrile bearing compound produced during photolysis evaporates between 200 and 250K, suggesting that it is carried by a small molecular species. These molecules could be similar to the source material in Comet Halley that is ejected in grains into the coma, freed by sublimation, and photolyzed by solar radiation to produce the observed jets. Author

N90-27581*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.
NATURE AND ORIGIN OF INTERSTELLAR DIAMOND FROM THE ALLENDE CV3 METEORITE Abstract Only **c90**
David Blake, Friedemann Freund, Ted Bunch, Kannan Krishnan, Alexander Tielens, Mitch Stampfer (California Univ., Berkeley. Lawrence Berkeley Lab.), and Sherwood Chang *In its* Carbon in the Galaxy: Studies from Earth and Space Apr. 1990 p 323-324 (For primary document see N90-27562 21-88)
Avail: NTIS HC A15/MF A02 CSCL 03B

Data and experimental evidence which support the contention that the C delta diamonds may result from grain-grain collisions in supernova shocks in the interstellar medium are presented. Fragments of the Allende CV3 chondrite were acid-treated. A whitish powder was obtained. For the Analytical Electron Microscopy (AEM) a small drop of ethanol suspension was transferred onto holey carbon support films on 3 mm EM grids. The AEM was performed on transmission-thin fragments of the material which overlay holes in the film, to eliminate interference from the substrate. Electron Spectroscopy for Chemical Analysis (ESCA) was performed on a large aliquot of C. Diamond was identified by selected area electron diffraction. Scanning

Transmission Electron Microscope / Energy Dispersive X-ray (STEM-EDS) microanalyses of the C delta diamond, using a light-element detector, show that oxygen and possibly nitrogen are the only impurities consistently present. ESCA spectra from bulk C delta material confirm the presence of N at a level of 0.35 percent or less. Under UV irradiation a yellow-red fluorescence is observed, consistent with that of natural diamonds containing substitutional N. Electron Energy Loss Spectra (EELS) were recorded at 2 eV resolution from the C delta diamond, high pressure synthetic diamond, a diamond film produced in a low pressure plasma by chemical vapor deposition (CVD) on a heated silicon substrate (Roy, 1987), graphite, and amorphous arc sputtered carbon. Comparison of the carbon K edge shape and fine structure shows the Allende C delta phase to be largely diamond, but with a significant pre-edge absorption feature indicative of transitions of C 1s electrons into pi asterisk orbitals which are absent in the purely sp(3)-bonded diamond but present in graphite and amorphous carbon. Author

N90-27582*# AeroChem Research Labs., Inc., Princeton, NJ.
AN IONIC MECHANISM OF CARBON FORMATION IN FLAMES Abstract Only **c25**
H. F. Calcote *In* NASA, Ames Research Center, Carbon in the Galaxy: Studies from Earth and Space Apr. 1990 p 325-326 (For primary document see N90-27562 21-88)
Avail: NTIS HC A15/MF A02 CSCL 21B

The formation of incipient carbon in flames can be described by a series of elementary reactions in which the precursor of soot is the ion C3H3+, and the major building block is acetylene, polyacetylenes, or other hydrocarbon fragments which are present in large concentrations. The precursor ion is produced by nonequilibrium chemi-ionization reactions, e.g., CH asterisk plus C2H2 yields C3H3+ plus e or CH asterisk plus O yields CHO+ plus e. The CHO+ rapidly becomes C3H3+ through a series of ion-molecule reactions. The chemi-ion then adds acetylene in a series of very rapid ion-molecule reactions producing larger and larger ions. Ions isomerize very rapidly to produce aromatic structures overcoming one of the major problems with neutral species mechanisms: how to form the first carbon ring. As the ions grow, their recombination rate coefficients with electrons increase so that the larger ions are removed by dissociative recombination. These neutral species now continue to grow by the addition of more acetylene producing even larger neutral species. With increasing size, the rate coefficient of electron attachment also increases causing the reaction to become important, depending upon the temperature. Appreciable concentrations of negative ions shift the ion removal process to dissociative ion-ion recombination, which is orders of magnitude slower than ion-electron recombination. As the neutral species continue to grow by the addition of acetylene, they gradually take on the aspect of particles, i.e., the bulk properties of the substance CxHy dominate over the chemical properties. This change is gradual and there is no distinct size at which a large molecule becomes a particle. Evidence will be presented supporting the above mechanism. All of the ions proposed in the mechanism have been observed by mass spectrometric analysis, their concentrations measured, and their rates of reaction in the flame environment determined to be adequate to account for the observed rate of formation of carbon. Author

N90-27583*# Texas Univ., Austin. Dept. of Astronomy.
ON PLANETARY NEBULAE AS SOURCES OF CARBON DUST: INFRARED EMISSION FROM PLANETARY NEBULAE OF THE GALACTIC HALO Abstract Only **c90**
Harriet L. Dinerstein and Daniel F. Lester *In* NASA, Ames Research Center, Carbon in the Galaxy: Studies from Earth and Space Apr. 1990 p 327 (For primary document see N90-27562 21-88)
(Contract JPL-957285)
Avail: NTIS HC A15/MF A02 CSCL 03B

Planetary nebulae of the galactic disk are generally seen to emit a thermal continuum due to dust grains heated by stellar and nebular photons. This continuum typically peaks between 25 and 60 micron m, so that the total power emitted by the dust is sampled well by the broad-band measurements made by IRAS. Researchers examine here the characteristics of the infrared emission from the four planetary nebulae which are believed on the basis of their low overall metallicities to belong to the halo population. These nebulae are of particular interest because they are the most metal-poor ionized nebulae known in our Galaxy, and offer the opportunity to probe possible dependences of the dust properties on nebular composition. Researchers present fluxes extracted from co-addition of the IRAS data, as well as ground-based near infrared measurements. Each of the four halo objects, including the planetary nebula in the globular cluster M15, is detected in at least one infrared band. Researchers compare the estimated infrared excesses of these nebulae (IRE, the ratio of measured infrared power to the power available in the form of resonantly-trapped Lyman alpha photons) to those of disk planetary nebulae with similar densities but more normal abundances. Three of the halo planetaries have IRE values similar to those of the disk nebulae, despite the fact that their Fe- and Si-peak gas phase abundances are factors of 10 to 100 lower. However, these halo nebulae have normal or elevated C/H ratios, due to nuclear processing and mixing in their red giant progenitors. Unlike the other halo planetaries, DDDM1 is deficient in carbon as well as in the other light metals. This nebula has a substantially lower IRE than the other halo planetaries, and may be truly dust efficient. Researchers suggest that the deficiency is due to a lack of the raw material for producing carbon-based grains, and that the main bulk constituent of the dust in these planetary nebulae is carbon. Author

N90-27584*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.
IMPACT FRACTURE EXPERIMENTS SIMULATING INTERSTELLAR GRAIN-GRAIN COLLISIONS Abstract Only **c90**
Friedemann Freund, Sherwood Chang, and J. Thomas Dickinson (Washington State Univ., Pullman.) *In its* Carbon in the Galaxy: Studies from Earth and Space Apr. 1990 p 328-329 (For primary document see N90-27562 21-88)
Avail: NTIS HC A15/MF A02 CSCL 03B

Oxide and silicate grains condensing during the early phases of the formation of the solar system or in the outflow of stars are exposed to high partial pressures of the low-z elements H, C, N and O and their simple gaseous compounds. Though refractory minerals are nominally anhydrous and non-carbonate, if they crystallize in the presence of H2O, N2 and CO or CO2 gases, they dissolve traces of the gaseous components. The question arises: How does the presence of dissolved gases or gas components manifest itself when grain-grain collisions occur. What are the gases emitted when grains are shattered during a collision event. Researchers report on fracture experiments in ultrahigh vacuum (UHV, approximately less than 10 to the -8th power mbar) designed to measure (by means of a quadrupole mass spectrometer, QMS, with microns to ms time resolution) the emission of gases and vapors during and after impact (up to 1.5 sec). Two terrestrial materials were chosen which represent structural and compositional extremes: olivine (San Carlos, AZ), a densely packed Mg-Fe(2+) silicate from the upper mantle, available as 6 to 12 mm single crystals, and obsidian (Oregon), a structurally open, alkaline-SiO2-rich volcanic glass. In the olivine crystals OH-groups have been identified spectroscopically, as well as H2 molecules. Obsidian is a water-rich glass containing OH- besides H2O molecules. Olivine from the mantle often contains CO2, either as CO2-rich fluid in fluid inclusions or structurally dissolved or both. By analogy to synthetic glasses CO2 in the obsidian may be present in form of CO2 molecules in voids of molecular dimensions, or as carbonate anions, CO3(2-). No organic molecules have been detected spectroscopically in either material. Results indicate that refractory oxide/silicates which contain dissolved traces of the H2O and CO/CO2 components but no spectroscopically detectable traces of organics may release complex H-C-O (possibly H-C-N-O) molecules upon fracture, plus metal vapor. This points: (1) at complex reaction mechanisms

between dissolved H2O, CO/CO2 (and N2) components within the mineral structure or during fracture, and (2) at the possibility that similar emission processes occur following grain-grain collisions in interstellar dust clouds. Author

N90-27585*# Los Alamos National Lab., NM.
DIAMONDS IN DETONATION SOOT Abstract Only **c25**
N. Roy Greiner, Dave Phillips, J. D. Johnson, and Fred Volk (Fraunhofer-Inst. fuer Treib- und Explosivstoffe, Pfinztal-Berghausen, Germany, F.R.) *In* NASA, Ames Research Center, Carbon in the Galaxy: Studies from Earth and Space Apr. 1990 p 330 (For primary document see N90-27562 21-88)
Avail: NTIS HC A15/MF A02 CSCL 11G

Diamonds 4 to 7 nm in diameter have been identified and partially isolated from soot formed in detonations of carbon-forming composite explosives. The morphology of the soot has been examined by transmission electron microscopy (TEM), and the identity of the diamond has been established by the electron diffraction pattern of the TEM samples and by the X-ray diffraction (XRD) pattern of the isolated solid. Graphite is also present in the form of ribbons of turbostatic structure with a thickness of 2 to 4 nm. A fraction, about 25 percent of the soot by weight, was recovered from the crude soot after oxidation of the graphite with fuming perchloric acid. This fraction showed a distinct XRD pattern of diamond and the diffuse band of amorphous carbon. The IR spectrum of these diamonds closely matches that of diamonds recovered from meteorites (Lewis et al., 1987), perhaps indicating similar surface properties after the oxidation. If these diamonds are produced in the detonation itself or during the initial expansion, they exhibit a phenomenal crystal growth rate (5 nm/0.00001 s equal 1.8 m/hr) in a medium with a very low hydrogen/carbon ratio. Because the diamonds will be carried along with the expanding gases, they will be accelerated to velocities approaching 8 km/s. Author

N90-27586*# Lawrence Livermore National Lab., CA.
PROBING THE POSSIBILITY OF A C-12/C-13 GALACTIC ABUNDANCE GRADIENT Abstract Only **c90**
Isabel Hawkins *In* NASA, Ames Research Center, Carbon in the Galaxy: Studies from Earth and Space Apr. 1990 p 331-332 (For primary document see N90-27562 21-88)
Avail: NTIS HC A15/MF A02 CSCL 03B

High S/N (equal to or greater than 500) observations of interstellar CH+ with the 3.0 m telescope were performed at Lick Observatory and with the 4.0 m telescope at CTIO, of the reddened, early-type stars HD 183143, HD 24432, and HD 157038 in an effort to probe the existence of a C-12/C-13 abundance gradient in our Galaxy. Previous very high quality optical observations of interstellar CH+ toward five stars within 1 kpc of the Sun have yielded a precise weighted mean C-12/C-13 isotope ratio of 43 plus or minus 4 (1 sigma) (Hawkins, Jura, and Meyer 1985; Hawkins and Jura 1987). The isotope ratios derived toward four lines of sight in the local ISM are uniform within 12 percent. The similarity among these carbon isotope ratios determined in diffuse clouds possessing different physical conditions precludes the possibility that the CH+ molecule is suffering from isotope selective effects in these regions. The precise C-12/C-13 derivable from high quality observations of (12)CH+ and (13)CH+ provide the unique opportunity to probe the homogeneity of the ISM in a large scale and the history of nucleosynthesis in our Galaxy. Since CH+ seems to be the most sensitive probe of C-12/C-13 in the diffuse ISM, observations toward more distant stars located up to 2.5 kpc from the Sun are the best way to study the possibility of a Galactic (C-12/C-13) abundance gradient. The researcher obtained 4232 angstrom data toward all three of the stars mentioned above, 3957 angstrom data toward HD 183143 and HD 157038, and 3745 angstrom data toward HD 157038. Because of the poorer quality of the HD 24432 spectrum, and its weaker CH+ absorption lines, the satellite (13)CH+ line was not detected, and thus only a lower limit on the C-12/C-13 ratio toward this star was obtained. The results obtained from careful reduction and analysis of the data toward these stars in the Northern and Southern Hemispheres are presented. Author

N90-27587*# Massachusetts Univ., Amherst. Five College Radio Astronomy Observatory.
NEW OBSERVATIONS OF INTERSTELLAR ORGANIC MOLECULES Abstract Only **c89**
W. M. Irvine, P. Friberg, H. E. Matthews (Herzberg Inst. of Astrophysics, Ottawa, Ontario), Y. C. Minh, and L. M. Ziurys *In* NASA, Ames Research Center, Carbon in the Galaxy: Studies from Earth and Space Apr. 1990 p 333-334 (For primary document see N90-27562 21-88)
Avail: NTIS HC A15/MF A02 CSCL 03A

Discussed here are new observations of 3-carbon-containing interstellar molecules which play an important role in the chemistry of dense molecular clouds: protonated carbon dioxide, formic acid, and propynal. In 1984 a new oxide of carbon, C3O, was discovered in the interstellar medium (Matthews et al. 1984; Brown et al. 1985). Theoretical models suggest that C3O is produced by dissociative electron recombination with the ion H3C3O+. Although no laboratory data for the branching ratios of such a recombination exist, it seemed to us likely that additional products would include H2C3O. This molecule has more than one isomeric form, but one stable species is propynal (HC2CHO), which had been suggested as a possible interstellar molecule by Winnewisser (1973). In observations at the National Radio Astronomy Observatory 43 m telescope in Green Bank earlier this year, researchers detected a line in the cold cloud TMC-1 which they assign to the 2(0,2)-1(0,1) transition of propynal. The observed line agrees with the laboratory frequency to well within the experimental uncertainty a few parts in 10 to the 7th power. Researchers sought and failed to detect the corresponding 2(1,1)-1(1,0) line, which is understandable given the presence of both a and b components of the electric dipole moment in propynal. The b type transitions will drain population from energy levels with K(sub p) does not equal 0 into the K(sub p) equal 0 stack. If the researchers' assignment is correct, this is the first interstellar detection of propynal. Assuming typical rotational temperatures for TMC-1 and that the line is optically thin, the column density determined is about 5 times 10 to the 12th power cm to the -2nd power, or about three times that for C3O. Formic acid (HCOOH) was the first organic acid to be observed in the interstellar medium, in the Galactic center source Sgr B2. The only other interstellar detection has been recently made in the giant molecular cloud in Orion. As part of the same project that led to the detection of propynal, researchers sought formic acid in the nearby, cold dark clouds TMC-1 and L134N. It is seen only in L134N. This difference between the two clouds appears to be consistent with a model in which the oxygen/carbon ratio is higher in L134N. This would be consistent with the higher abundances for SO and SO2, observed in that cloud, and the higher abundances of many carbon-rich species in TMC-1 (Irvine et al. 1985). Author

N90-27588*# State Univ. of New York, Stony Brook.
SEARCH FOR INTERSTELLAR METHANE Abstract Only **c89**
R. F. Knacke, Y. H. Kim, K. S. Noll, and T. R. Geballe (United Kingdom Infrared Telescope Unit, Hilo, HI.) *In* NASA, Ames Research Center, Carbon in the Galaxy: Studies from Earth and Space Apr. 1990 p 335 (For primary document see N90-27562 21-88)
Avail: NTIS HC A15/MF A02 CSCL 03A

Researchers searched for interstellar methane in the spectra of infrared sources embedded in molecular clouds. New observations of several lines of the P and R branches of the nu 3 band of CH4 near 3.3 microns give column densities in the range N less than 1(-2) times 10 to the minus 16th power cm(-2). Resulting abundance ratios are (CH4)/(CO) less than 3.3 times 10 to the minus 2nd power toward GL961 in NGC 2244 and less than 2.4 times 10 to the minus 3rd power toward GL989 in the NGC 2264 molecular cloud. The limits, and those determined in earlier observations of BN in Orion and GL490, suggest that there is little methane in molecular clouds. The result agrees with predictions of chemical models. Exceptions could occur in clouds where oxygen may be depleted, for example by H2O freezing on grains. The present observations probably did not sample such regions. Author

N90-27589*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.

RAMAN SPECTROSCOPIC STUDIES OF CARBON IN EXTRA-TERRESTRIAL MATERIALS Abstract Only **c90**

John Macklin, Donald Brownlee, Sherwood Chang, and Ted Bunch (Washington Univ., Seattle.) *In its* Carbon in the Galaxy: Studies from Earth and Space Apr. 1990 p 336 (For primary document see N90-27562 21-88)

Avail: NTIS HC A15/MF A02 CSCL 03B

The measurements obtained here indicate ways in which micro-Raman spectroscopy can be used to elucidate structural characteristics and distribution of carbon in meteorites and interplanetary dust particles (IDPs). Existing information about structurally significant aspects of Raman measurements of graphite is combined with structurally relevant findings from the present micro-Raman studies of carbons prepared by carbonization of polyvinylidine chloride (PVDC) at various temperatures and natural material, as well as several acid residues from the Allende and Murchison meteorites in order to establish new spectra-structure relationships. Structural features of many of the materials in this study have been measured by x ray analysis and electron microscopy: thus, their structural differences can be directly correlated with differences in the Raman spectra. The spectral parameters consequently affirmed as indicators of structure are used as a measure of structure in materials that have unknown carbon structure, especially IDPs. The unique applicability of micro-Raman spectroscopy is realized not only in the ability to conveniently measure spectra of micron-size IDPs, but also micro-sized parts of an inhomogeneous material. Microcrystalline graphite is known to give Raman spectra that differ dependent on crystallite size (see e.g., Lespade, et. al., 1984, or Nemanich and Solin, 1979). The spectral changes that accompany decreasing particle size include increase in the ratio (R) of the intensity of the band near 1350 cm(-1) (D band) to that of the band near 1600 cm(-1) (G band) increase in the half width of the D band (wD) increase in the frequency maximum of the G band and increase in the half-width (wG) of the 2nd order band near 2700 cm(-1) (G) band. Author

N90-27590*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.

CAN THE CHIRALITY OF THE ISM BE MEASURED Abstract Only **c90**

Y. Pendleton, S. A. Sandford, Michael W. Werner, J. Lauer, and Sherwood Chang *In its* Carbon in the Galaxy: Studies from Earth and Space Apr. 1990 p 337-338 (For primary document see N90-27562 21-88)

Avail: NTIS HC A15/MF A02 CSCL 03B

Many moderately complex carbon-based molecules of the type associated with biological systems can exist in one of two mirror-image forms (left-handed and right-handed), which can be distinguished on the basis of their influence on the state of polarization of a light beam. Both forms are possible in nature; yet in living organisms it is invariably the rule that one of these two species predominates. This gives rise to a net chirality. One possible explanation for the net chirality is that the early earth was somehow seeded from the ISM with an excess of chiral organic compounds which led to the development of life forms which are based on left-handed amino acids and right-handed sugars. Molecular spectroscopy of the interstellar medium (ISM) has revealed a complex variety of molecular species similar to those thought to have been available in the oceans and atmospheres of the earth at the time life formed. The detection of such molecules demonstrates the generality of the chemical processes occurring in both environments. If this generality extends to the processes which produce chirality, it may be possible to detect a net chirality in the ISM. This is of particular interest because determining whether or not net chirality exists elsewhere in the universe is an essential aspect of understanding how life developed on earth and how widely distributed it might be. Researchers report preliminary results of a feasibility study to determine whether or not a net chirality in the ISM can be measured. If laboratory results identify candidate chiral molecules that might exist in the ISM, the next step in this feasibility study will be to estimate the detectability of the chiral signature in astrophysical environments. Author

N90-27591*# New Mexico Univ., Albuquerque. Dept. of Geology.

ON DIAMOND, GRAPHITIC AND AMORPHOUS CARBONS IN PRIMITIVE EXTRATERRESTRIAL SOLAR SYSTEM MATERIALS Abstract Only **c90**

Frans J. M. Rietmeijer *In* NASA, Ames Research Center, Carbon in the Galaxy: Studies from Earth and Space Apr. 1990 p 339-340 (For primary document see N90-27562 21-88)

Avail: NTIS HC A15/MF A02 CSCL 03B

Carbon is among the most abundant elements in the universe and carbon chemistry in meteorites and comets is an important key to understanding many Solar System and interstellar processes. Yet, the mineralogical properties and interrelations between various structural forms of elemental carbon remain ambiguous. Crystalline elemental carbons include rhombohedral graphite, hexagonal graphite, cubic diamond, hexagonal diamond (i.e., lonsdaleite or carbon-2H) and chaoite. Elemental carbon also occurs as amorphous carbon and poorly graphitized (or turbostratic) carbon but of all the forms of elemental carbon only graphite is stable under physical conditions that prevail in small Solar System bodies and in the interstellar medium. The recent discovery of cubic diamond in carbonaceous chondrites and hexagonal diamond in chondritic interplanetary dust particles (IDPs) have created a renewed interest in the crystalline elemental carbons that were not formed by shock processes on a parent body. Another technique, Raman spectroscopy, confirms a widespread occurrence of disordered graphite in the Allende carbonaceous chondrite and in chondritic IDPs. Elemental carbons have also been identified by their characteristic K-edge features in electron energy loss spectra (EELS). However, the spectroscopic data do not necessarily coincide with those obtained by selected area electron diffraction (SAED). In order to interpret these data in terms of rational crystalline structures, it may be useful to consider the principles underlying electron diffraction and spectroscopic analyses. Electron diffraction depends on electron scattering, on the type of atom and the distance between atoms in a crystal lattice. Spectroscopic data are a function of the type of atom and the energy of bonds between atoms. Also, SAED is a bulk sampling technique when compared to techniques such as Raman spectroscopy or EELS. Thus, it appears that combined analyses provide contradictory results and that amorphous, or short-range ordered, carbon identified by conventional TEM imaging and SAED may show evidence for sp(3) bonds in EELS spectra. It is suggested that complex, nanometer-scale, mineralogical interrelations are common to all elemental carbons irrespective of their origin. The subsequent thermal history, or energy balance, will determine the ultimate microstructure. Author

N90-27592*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, MD.

FT-IR SPECTROSCOPIC STUDIES OF POLYCYCLIC AROMATIC HYDROCARBONS Abstract Only **c25**

D. W. Salisbury, J. E. Allen, Jr., B. Donn, W. J. Moore, and R. K. Khanna (Naval Research Lab., Washington, DC.) *In* NASA, Ames Research Center, Carbon in the Galaxy: Studies from Earth and Space Apr. 1990 p 341 (For primary document see N90-27562 21-88)

Avail: NTIS HC A15/MF A02 CSCL 07D

Proper assessment of the hypothesis which correlates polycyclic aromatic hydrocarbons (PAHs) with the unidentified infrared emission bands requires additional experimental laboratory data. In order to address this need, thermal infrared emission studies were performed on a subset of PAHs suggested to be of astrophysical importance. It was proposed that infrared emission from interstellar PAHs occurs following absorption of an ultraviolet photon. Since energy transfer to the ground electronic state can be rapid for a species in which intersystem crossing is negligible, the emission spectrum may be viewed as resulting from an equilibrium vibrational temperature (Leger and d'Hendecourt, 1987).

This has been the basis for using infrared absorption spectra to calculate the corresponding emission spectra at various temperatures. These calculations were made using room temperature infrared absorption coefficients instead of those at the temperature of interest because of the latter's unavailability. The present studies are designed to address the differences between the calculated and experimental thermal emission spectra and to provide information which will be useful in future ultraviolet induced infrared fluorescence studies. The emission spectra have been obtained for temperatures up to 825K using an emission cell designed to mount against an external port of an FT-IR spectrometer. These spectra provide information concerning relative band intensities and peak positions which is unavailable from previous calculations. Author

N90-27593*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.
CARBON IN THE OUTER SOLAR SYSTEM Abstract Only c90
D. P. Simonelli, J. B. Pollack, and C. P. McKay *In its* Carbon in the Galaxy: Studies from Earth and Space Apr. 1990 p 342-343 (For primary document see N90-27562 21-88)
Avail: NTIS HC A15/MF A02 CSCL 03B

The satellites of Uranus, with densities between 1.3 and 1.7 g cm(-3) (from Voyager 2 observations) and the Pluto-Charon system, with a mean density of just above 1.8 g cm(-3) (from terrestrial observations of mutual eclipse events), are too dense to have a significant amount of methane ice in their interiors. However, the observed densities do not preclude contributions from such organic materials as the acid-insoluble residue in carbonaceous chondrites and laboratory-produced tholins, which have densities on the order of approximately 1.5 g cm(-3). These and other considerations have led researchers to investigate the carbon mass budget in the outer solar system, with an emphasis on understanding the contribution of organic materials. Modeling of the interiors of Pluto and Charon (being carried out by R. Reynolds and A. Summers of NASA/Ames), assuming rock and water ice as the only constituents, suggests a silicate mass fraction for this system on the order of 0.65 to 0.70. The present work includes the most recent estimates of the C/H enhancements and high z/low z ratios of the giant planets (Pollack and Bodenheimer, 1987), and involves a more careful estimation of the high z/low z mass ratio expected from solar abundances than was used in Pollack et al. (1986), including the influence of the fraction of C in CO on the amount of condensed water ice. These calculations indicate that for a particular fraction of C in CO and a given fraction of C-bearing planetesimals that dissolve in the envelope (most likely in the range 0.50 to 0.75), (1) Jupiter and Saturn require a larger fraction of C in condensed materials than Uranus and Neptune, but (2) the Jupiter and Saturn results are much less strongly constrained by the error bars on the observed C/H enhancements and high z/low z ratios than is the case for Uranus and Neptune. The clearest result is that in the region of the solar nebula near Uranus and Neptune, the minority of carbon that is not in gaseous CO (1) must include a nonzero amount of condensed material, but (2) is most likely not condensed material alone, i.e., there must be a third carbon-bearing component besides condensed material and gaseous CO. Given the implied dearth of methane ice, the condensed carbon is likely dominated by organic material, and the third component present in addition to CO and organics is assumed to be CH4 gas. Author

89 ASTRONOMY

Includes radio, gamma-ray, and infrared astronomy, and astrometry.

N90-27594*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, AL.
VARIABLE MAGNIFICATION VARIABLE DISPERSION GLANCING INCIDENCE IMAGING X RAY SPECTROSCOPIC TELESCOPE Patent Application
Richard Hoover, inventor (to NASA) 28 Jun. 1990 37 p
(NASA-Case-MFS-28013-3; NAS 1.71:MFS-28013-3; US-Patent-Appl-SN-545089) Avail: NTIS HC A03/MF A01 CSCL 03A

A variable magnification variable dispersion glancing incidence x ray spectroscopic telescope capable of multiple high spatial revolution imaging at precise spectral lines of solar and stellar x ray and extreme ultraviolet radiation sources includes a primary optical system which focuses the incoming radiation to a primary focus. Two or more rotatable carriers each providing a different magnification are positioned behind the primary focus at an inclination to the optical axis, each carrier carrying a series of ellipsoidal diffraction grating mirrors each having a concave surface on which the gratings are ruled and coated with a multilayer coating to reflect by diffraction a different desired wavelength. The diffraction grating mirrors of both carriers are segments of ellipsoids having a common first focus coincident with the primary focus. A contoured detector such as an x ray sensitive photographic film is positioned at the second respective focus of each diffraction grating so that each grating may reflect the image at the first focus to the detector at the second focus. The carriers are selectively rotated to position a selected mirror for receiving radiation from the primary optical system, and at least the first carrier may be withdrawn from the path of the radiation to permit a selected grating on the second carrier to receive radiation. NASA

N90-27595*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, AL.
MULTISPECTRAL VARIABLE MAGNIFICATION GLANCING INCIDENCE X RAY TELESCOPE Patent Application
Richard Hoover, inventor (to NASA) 28 Jun. 1990 30 p
(NASA-Case-MFS-28013-4; NAS 1.71:MFS-28013-4; US-Patent-Appl-SN-545008) Avail: NTIS HC A03/MF A01 CSCL 03A

A multispectral variable magnification glancing incidence x ray telescope capable of broadband, high resolution imaging of solar and stellar x ray and extreme ultraviolet radiation sources includes a primary optical system which focuses the incoming radiation to a primary focus. Two or more rotatable mirror carriers each providing a different magnification are positioned behind the primary focus at an inclination to the optical axis, each carrier carrying a series of ellipsoidal mirrors each having a concave surface coated with a multilayer (layered synthetic microstructure) coating to reflect a different desired wavelength. The mirrors of both carriers are segments of ellipsoids having a common first focus coincident with the primary focus. A detector such as an x ray sensitive photographic film is positioned at the second respective focus of each mirror so that each mirror may reflect the image at the first focus to the detector at the second focus. The carriers are selectively rotated to position a selected mirror for receiving radiation from the primary optical system, and at least the first carrier may be withdrawn from the path of the radiation to permit a selected mirror on the second carrier to receive the radiation. NASA

N90-27596# Texas Univ., Austin. Dept. of Astronomy.
INFRARED MAPPING WITH A TWO-DIMENSIONAL INFRARED ARRAY Final Report, 1 Feb. 1986 - 31 Jul. 1989
Paul M. Harvey 6 Feb. 1990 5 p
(Grant AF-AFOSR-0083-86; AF Proj. 2311)
(AD-A221938; AFOSR-90-0601TR) Avail: NTIS HC A01/MF A01 CSCL 03/1

The research involved the completion of hardware development of a two-dimensional infrared camera system based on a 62 x 58 infrared array detector. The second phase involved an observational program to study the infrared brightness and colors of infrared galaxies particularly those in interacting systems. The final part of the program was a small exploratory inquiry into the feasibility of very high angular resolution imaging via speckle interferometry in the infrared. GRA

N90-27597# Utah Univ., Salt Lake City. Dept. of Mechanical Engineering.
INFRARED OBSERVATIONS OF THE SOLAR SYSTEM IN SUPPORT OF LARGE APERTURE INFRARED TELESCOPE (LARITS): CALIBRATION Final Technical Report, 1 Jul. 1985 - 28 Feb. 1989
Richard W. Shorthill 2 May 1990 22 p
(Grant AF-AFOSR-0181-85; AF Proj. 2311)
(AD-A222222; AFOSR-90-0645TR) Avail: NTIS HC A03/MF A01 CSCL 03/2

The purpose of this project was to improve the infrared calibration base for infrared detectors. Groundbased infrared measurements of solid-surfaced planetary bodies, such as asteroids, are being used for the calibration of spacecraft detectors. A limitation has been the relatively poor theoretical understanding of thermal emission from these objects. The goal was to: (1) develop a database of sources, and (2) improve or modify the thermal models for these sources to provide a calibration data base for spacecraft infrared detector systems. The technique consisted of five phases: (1) design and construct infrared detector system to be used with and without collecting optics, (2) acquire whole-disk infrared lunar data relative to a laboratory blackbody and tie them to Mars (Venus or Mercury) and Vega, (3) compare with thermophysical model of the mood and modify, (4) acquire infrared asteroid photometry, and (5) compare the lunar disk photometry the asteroid calibrators using photometry and thermophysical models. The Si bolometer is calibrated without optics, attached to the portable telescope drive and Lunar disk measurement made. Next the bolometer is attached to the 90 inch telescope. Lunar scans are made and the remaining objects (planets, stars, asteroids) are measured. GRA

N90-27598# Utah Univ., Salt Lake City. Dept. of Mechanical Engineering.
INFRARED OBSERVATIONS OF THE SOLAR SYSTEM IN SUPPORT OF LARGE APERTURE INFRARED TELESCOPE (LARITS): CALIBRATION. APPENDICES Final Technical Report, 1 Jul. 1985 - 28 Feb. 1989
Richard W. Shorthill 2 May 1990 165 p
(Grant AF-AFOSR-0181-85; AF Proj. 2311)
(AD-A222245; AFOSR-90-0645TR-App) Avail: NTIS HC A08/MF A01 CSCL 03/2

An infrared (IR) optics package designed for a IR detector calibration survey will be used in conjunction with the 90 inch telescope at the University of Wyoming, or as a portable, stand along unit. An important part of this instrument package is a mechanical light beam chopper which rotates with a fixed phase relation with respect to a wobbling secondary mirror in the telescope. A control circuit synchronizes the chopper to an external signal when used at the Wyoming site, or generates an internal reference frequency when used as a portable system. The portable system consists of a small equatorial telescope mount to support the same IR instrumentation package, which is used without additional optics. An automated positioning and tracking system encorporates a personal computer to control the environment of the telescope mount via stepper motors attached to the drive axis. The computer is also used to record all data on floppy disc for both fixed and portable systems. GRA

N90-27599# Smithsonian Astrophysical Observatory, Cambridge, MA.
HIGH RESOLUTION OPTICAL IMAGING THROUGH THE ATMOSPHERE Final Report, 1 Feb. 1986 - 30 Sep. 1989
R. W. Noyes, P. Nisenson, R. V. Stachnik, and C. Papaliolios 28 Dec. 1989 57 p
(Grant AF-AFOSR-0103-86; AF Proj. 2311)
(AD-A221913; AFOSR-90-0603TR) Avail: NTIS HC A04/MF A01 CSCL 03/1

This program has concentrated on three major areas: the application of high angular resolution image reconstruction techniques to the reconstruction of solar surface features; speckle imaging of a wide range of astronomical sources; and the implementation of adaptive optics for faint object imaging. Substantial modifications were made to a technique for reconstruction of high resolution images from single short exposure solar frames, blind iterative deconvolution (IDC). These improvements were tested using numerical simulation data. Analysis of speckle data of the supernova SN1987A has detected a new bright source, 0.9 arcseconds south of the SN, as well as substantial structure in the region surrounding the SN. New results were obtained on several Young Stellar Objects and supergiants. In the area of adaptive optics, an AOA wavefront sensor has been set up and tested using an image intensifier which increases its sensitivity by three orders of magnitude. Faint object image active tilt correction was also tested with some important enhancements, including new highly linear and sensitive CCD quad cells developed by Cal Tech and Tektronix, and an off-the-shelf high speed 2-D tilting mirror with greatly improved specifications. The effects of only partially correcting atmospheric turbulence have been theoretically analyzed and numerically simulated. GRA

N90-27566*# California Univ., Los Angeles.
ASTRONOMICAL OBSERVATIONS OF SOLID PHASE CARBON
M. Jura *In* NASA, Ames Research Center, Carbon in the Galaxy: Studies from Earth and Space Apr. 1990 p 39-45 (For primary document see N90-27562 21-88)
Avail: NTIS HC A15/MF A02 CSCL 03A

N90-27577*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.
SIRTF: PROBING THE DARK CORNERS OF THE GALAXY
Michael W. Werner and Dora S. Willoughby (Information Management International, Inc., Palo Alto, CA.) *In its* Carbon in the Galaxy: Studies from Earth and Space Apr. 1990 p 287-302 (For primary document see N90-27562 21-88)
Avail: NTIS HC A15/MF A02 CSCL 03A

N90-27587*# Massachusetts Univ., Amherst. Five College Radio Astronomy Observatory.
NEW OBSERVATIONS OF INTERSTELLAR ORGANIC MOLECULES Abstract Only
W. M. Irvine, P. Friberg, H. E. Matthews (Herzberg Inst. of Astrophysics, Ottawa, Ontario), Y. C. Minh, and L. M. Ziurys *In* NASA, Ames Research Center, Carbon in the Galaxy: Studies from Earth and Space Apr. 1990 p 333-334 (For primary document see N90-27562 21-88)
Avail: NTIS HC A15/MF A02 CSCL 03A

N90-27588*# State Univ. of New York, Stony Brook.
SEARCH FOR INTERSTELLAR METHANE Abstract Only
R. F. Knacke, Y. H. Kim, K. S. Noll, and T. R. Geballe (United Kingdom Infrared Telescope Unit, Hilo, HI.) *In* NASA, Ames Research Center, Carbon in the Galaxy: Studies from Earth and Space Apr. 1990 p 335 (For primary document see N90-27562 21-88)
Avail: NTIS HC A15/MF A02 CSCL 03A

90 ASTROPHYSICS

Includes cosmology; celestial mechanics; space plasmas; and interstellar and interplanetary gases and dust.
For related information see also *75 Plasma Physics*.

N90-27600 Princeton Univ., NJ.
DISK MASS DENSITIES IN EDGE-ON SPIRAL GALAXIES Ph.D. Thesis
Michael Perry Rupen 1989 392 p
Avail: Univ. Microfilms Order No. DA8917778

Very Large Array (VLA) observations of the neutral hydrogen gas in two nearby edge-on spirals (NGC 4565 and NGC 891) successfully resolve the thickness of the gas layers in both disks over a wide range in radii. The combination of B, C, and D array data produces a 4 arcsec beam and 21 km/s velocity resolution, combined with sensitivity to structures as large as 18 arcmin. These observations directly constrain the mid-plane disk mass densities, under the assumption of an equilibrium between the

thermal pressure of the gas and the gravitational attraction of the disk. The results of a preliminary analysis are given. These data also allow a detailed study of the H I in these galaxies; in general their brightness temperature distributions seem similar to that in the Milky Way. Both galaxies show asymmetric H I extensions beyond the optical disk. In NGC 4565 the extension is a surprisingly abrupt warp, which may bend back to parallel the galactic plane; the velocity structure implies the warp is continuous around the disk. Author

N90-27601# Lawrence Livermore National Lab., CA.
COSMIC BOMBARDMENT 2: INTERCEPTING THE BOMBLETS COST-EFFICIENTLY
Lowell Wood, Rod Hyde, and Muriel Y. Ishikawa 1 May 1990 11 p
(Contract W-7405-eng-48)
(DE90-010401; UCRL-ID-103771) Avail: NTIS HC A03/MF A01

In the present paper, we consider ways-and-means of dealing with earthstrikes of micro-asteroids, bodies which are so small — and so numerous — that they strike the Earth every century to every year. These are time-scales so brief that they are of interest to contemporary human individuals and institutions. We are particularly concerned with not only the detection and disposal of cosmic objects which threaten to bombard the Earth, but with practical questions such as cost-to-benefit ratios and implementing means for planetary defenses which are at once near-term, robust and unquestionably acceptable. In the sections which follow, we briefly review those aspects of the cosmic bombardment of the Earth which are of concern during the next several decades. We first take note of the frequency with which the Earth will be struck by asteroids of various sizes and note the corresponding physical damage levels. Then, we translate this into economic damage levels, so as to arrive at the denominator of the cost-benefit ratio of a shield against such bombardment. Next, we consider how such a shield might be realized, emphasizing minimization of its total operating cost (amortization plus operation-and-maintenance) while providing the required reliability. Having developed a cost estimate, we then discuss the cost-benefit ratio of defending humans and their works on this planet from cosmic bombardment. DOE

N90-27602# Hiroshima Univ., Takehara (Japan). Research Inst. for Theoretical Physics.
PROCEEDINGS OF WORKSHOP ON DARK MATTER AND THE STRUCTURE OF THE UNIVERSE
Misao Sasaki, ed. Oct. 1989 218 p Workshop held in Takehara, Japan, 29 Jan. - 1 Feb. 1989
(DE90-791308; RRK-89-28; CONF-8901190) Avail: NTIS (US Sales Only) HC A10

The workshop aimed at clarifying the basic theoretical problems of the dark matter and the structure of the universe, and gaining inspiration on the direction of future research. In the first half of the workshop, the observed data on the large scale structure were critically reviewed, and some new ideas and theoretical frameworks which relate the actual cosmological structure to the observable quantities were presented. In the second half of the workshop, the various possible matters being proposed for the dark matter were examined in the light of both observed (or experimental) data and theoretical predictions. The speakers in the workshop gave well prepared, stimulative talks, and made it possible for the participants to have fruitful and constructive discussions. DOE

N90-27603# Technische Univ., Berlin (Germany, F.R.). Fachbereich Physik.
THE EFFECT OF TIDAL FRICTION BETWEEN GALAXIES ON THE FORMATION AND DEVELOPMENT OF GALACTIC CLUSTERS IN THE EXPANDING UNIVERSE Ph.D. Thesis [DER EINFLUSS DER GEZEITENREIBUNG ZWISCHEN GALAXIEN AUF DIE BILDUNG UND ENTWICKLUNG VON GALAXIENHAUFEN IM EXPANDIERENDEN UNIVERSUM]
Peter Schwekendiek 1988 46 p In GERMAN
(ETN-90-97314) Avail: NTIS HC A03/MF A01

The formation and development of galactic clusters in Euclidean expanding universes were investigated using N-body simulation calculations. The dynamics of the galaxies were described by a continuously acting interaction term which takes into account gravitation, tidal friction and changes in the galaxy radii. In the elastic case, the galaxies remain clearly separated and the galactic groups are virialized. Inelastic interaction increases the galaxy radii and approaches the galaxy centers; often the inner part of a group is filled, with some galaxy molten with each other. The effective global mass of the groups can be double the virial mass. In the inelastic models the global two-point correlation function of the spatial galactic distribution follows the observed characteristic power law clearly better than in the elastic models. ESA

N90-27563*# California Univ., Los Angeles.
CARBON IN PRIMITIVE METEORITES
John F. Kerridge *In* NASA, Ames Research Center, Carbon in the Galaxy: Studies from Earth and Space Apr. 1990 p 3-20 (For primary document see N90-27562 21-88)
Avail: NTIS HC A15/MF A02 CSCL 03B

N90-27564*# Washington Univ., Seattle.
CARBON IN COMET DUST
D. E. Brownlee *In* NASA, Ames Research Center, Carbon in the Galaxy: Studies from Earth and Space Apr. 1990 p 21-25 (For primary document see N90-27562 21-88)
Avail: NTIS HC A15/MF A02 CSCL 03B

N90-27565*# Martin Marietta Aerospace, Denver, CO.
CARBON-RICH PARTICLES IN COMET HALLEY
Benton C. Clark *In* NASA, Ames Research Center, Carbon in the Galaxy: Studies from Earth and Space Apr. 1990 p 27-36 (For primary document see N90-27562 21-88)
(Contract JPL-956214)
Avail: NTIS HC A15/MF A02 CSCL 03B

N90-27567*# New Orleans Univ., LA. Dept. of Physics.
SURVIVAL OF CARBON GRAINS IN SHOCKS
C. Gregory Seab *In* NASA, Ames Research Center, Carbon in the Galaxy: Studies from Earth and Space Apr. 1990 p 47-58 (For primary document see N90-27562 21-88)
Avail: NTIS HC A15/MF A02 CSCL 03B

N90-27568*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.
CARBON STARDUST: FROM SOOT TO DIAMONDS
A. G. G. M. Tielens *In its* Carbon in the Galaxy: Studies from Earth and Space Apr. 1990 p 59-111 Prepared in cooperation with California Univ., Berkeley (For primary document see N90-27562 21-88)
Avail: NTIS HC A15/MF A02 CSCL 03B

N90-27569*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.
INTERSTELLAR GRAIN CHEMISTRY AND ORGANIC MOLECULES
L. J. Allamandola and S. A. Sandford *In its* Carbon in the Galaxy: Studies from Earth and Space Apr. 1990 p 113-146 (For primary document see N90-27562 21-88)
Avail: NTIS HC A15/MF A02 CSCL 03B

N90-27570*# California Univ., Berkeley.
CARBON CHEMISTRY OF CIRCUMSTELLAR ENVELOPES
John H. Bieging *In* NASA, Ames Research Center, Carbon in the Galaxy: Studies from Earth and Space Apr. 1990 p 147-157 (For primary document see N90-27562 21-88)
Avail: NTIS HC A15/MF A02 CSCL 03B

N90-27571*# California Inst. of Tech., Pasadena. Div. of Geological and Planetary Sciences.
CARBON CHEMISTRY IN DENSE MOLECULAR CLOUDS: THEORY AND OBSERVATIONAL CONSTRAINTS

Geoffrey A. Blake *In* NASA, Ames Research Center, Carbon in the Galaxy: Studies from Earth and Space Apr. 1990 p 159-179 (For primary document see N90-27562 21-88)
Avail: NTIS HC A15/MF A02 CSCL 03B

N90-27572*# California Inst. of Tech., Pasadena.
CI, CII, AND CO AS TRACERS OF GAS PHASE CARBON
Jocelyn Keene *In* NASA, Ames Research Center, Carbon in the Galaxy: Studies from Earth and Space Apr. 1990 p 181-196 (For primary document see N90-27562 21-88)
Avail: NTIS HC A15/MF A02 CSCL 03B

N90-27573*# Rice Univ., Houston, TX.
DOWN-TO-EARTH STUDIES OF CARBON CLUSTERS
R. E. Smalley *In* NASA, Ames Research Center, Carbon in the Galaxy: Studies from Earth and Space Apr. 1990 p 199-244 Sponsored in part by NSF and by the Robert A. Welch Foundation (For primary document see N90-27562 21-88)
Avail: NTIS HC A15/MF A02 CSCL 03B

N90-27574*# Minnesota Univ., Minneapolis. Supercomputer Inst.
ELECTRONIC AND MOLECULAR STRUCTURE OF CARBON GRAINS
Jan Almlof and Hans-Peter Luethi *In* NASA, Ames Research Center, Carbon in the Galaxy: Studies from Earth and Space Apr. 1990 p 245-258 (For primary document see N90-27562 21-88)
(Grant NSF CHE-86-10809)
Avail: NTIS HC A15/MF A02 CSCL 03B

N90-27575*# Pennsylvania State Univ., University Park.
A UNIFYING PICTURE OF GAS-PHASE FORMATION AND GROWTH OF PAH (POLYCYCLIC AROMATIC HYDROCARBONS), SOOT, DIAMOND AND GRAPHITE
Michael Frenklach *In* NASA, Ames Research Center, Carbon in the Galaxy: Studies from Earth and Space Apr. 1990 p 259-273 Sponsored in part by NASA, Lewis Research Center and by ONR (For primary document see N90-27562 21-88)
Avail: NTIS HC A15/MF A02 CSCL 03B

N90-27576*# Sussex Univ., Brighton (England). School of Chemistry and Molecular Sciences.
THE FORMATION AND STRUCTURE OF CIRCUMSTELLAR AND INTERSTELLAR DUST
H. W. Kroto *In* NASA, Ames Research Center, Carbon in the Galaxy: Studies from Earth and Space Apr. 1990 p 275-284 (For primary document see N90-27562 21-88)
Avail: NTIS HC A15/MF A02 CSCL 03B

N90-27579*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.
THE POSSIBLE PRESENCE OF INTERSTELLAR PAHs IN METEORITES AND INTERPLANETARY DUST PARTICLES Abstract Only
L. J. Allamandola, S. A. Sandford, and B. Wopenka (Washington Univ., Saint Louis, MO.) *In its* Carbon in the Galaxy: Studies from Earth and Space Apr. 1990 p 319-320 (For primary document see N90-27562 21-88)
Avail: NTIS HC A15/MF A02 CSCL 03B

N90-27580*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.
LABORATORY SIMULATION OF INTERSTELLAR GRAIN CHEMISTRY AND THE PRODUCTION OF COMPLEX ORGANIC MOLECULES Abstract Only
L. J. Allamandola, S. A. Sandford, and G. J. Valero *In its* Carbon in the Galaxy: Studies from Earth and Space Apr. 1990 p 321-322 (For primary document see N90-27562 21-88)
Avail: NTIS HC A15/MF A02 CSCL 03B

N90-27581*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.
NATURE AND ORIGIN OF INTERSTELLAR DIAMOND FROM THE ALLENDE CV3 METEORITE Abstract Only
David Blake, Friedemann Freund, Ted Bunch, Kannan Krishnan, Alexander Tielens, Mitch Stampfer (California Univ., Berkeley. Lawrence Berkeley Lab.), and Sherwood Chang *In its* Carbon in the Galaxy: Studies from Earth and Space Apr. 1990 p 323-324 (For primary document see N90-27562 21-88)
Avail: NTIS HC A15/MF A02 CSCL 03B

N90-27583*# Texas Univ., Austin. Dept. of Astronomy.
ON PLANETARY NEBULAE AS SOURCES OF CARBON DUST: INFRARED EMISSION FROM PLANETARY NEBULAE OF THE GALACTIC HALO Abstract Only
Harriet L. Dinerstein and Daniel F. Lester *In* NASA, Ames Research Center, Carbon in the Galaxy: Studies from Earth and Space Apr. 1990 p 327 (For primary document see N90-27562 21-88)
(Contract JPL-957285)
Avail: NTIS HC A15/MF A02 CSCL 03B

N90-27584*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.
IMPACT FRACTURE EXPERIMENTS SIMULATING INTERSTELLAR GRAIN-GRAIN COLLISIONS Abstract Only
Friedemann Freund, Sherwood Chang, and J. Thomas Dickinson (Washington State Univ., Pullman.) *In its* Carbon in the Galaxy: Studies from Earth and Space Apr. 1990 p 328-329 (For primary document see N90-27562 21-88)
Avail: NTIS HC A15/MF A02 CSCL 03B

N90-27586*# Lawrence Livermore National Lab., CA.
PROBING THE POSSIBILITY OF A C-12/C-13 GALACTIC ABUNDANCE GRADIENT Abstract Only
Isabel Hawkins *In* NASA, Ames Research Center, Carbon in the Galaxy: Studies from Earth and Space Apr. 1990 p 331-332 (For primary document see N90-27562 21-88)
Avail: NTIS HC A15/MF A02 CSCL 03B

N90-27589*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.
RAMAN SPECTROSCOPIC STUDIES OF CARBON IN EXTRA-TERRESTRIAL MATERIALS Abstract Only
John Macklin, Donald Brownlee, Sherwood Chang, and Ted Bunch (Washington Univ., Seattle.) *In its* Carbon in the Galaxy: Studies from Earth and Space Apr. 1990 p 336 (For primary document see N90-27562 21-88)
Avail: NTIS HC A15/MF A02 CSCL 03B

N90-27590*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.
CAN THE CHIRALITY OF THE ISM BE MEASURED Abstract Only
Y. Pendleton, S. A. Sandford, Michael W. Werner, J. Lauer, and Sherwood Chang *In its* Carbon in the Galaxy: Studies from Earth and Space Apr. 1990 p 337-338 (For primary document see N90-27562 21-88)
Avail: NTIS HC A15/MF A02 CSCL 03B

N90-27591*# New Mexico Univ., Albuquerque. Dept. of Geology.
ON DIAMOND, GRAPHITIC AND AMORPHOUS CARBONS IN PRIMITIVE EXTRATERRESTRIAL SOLAR SYSTEM MATERIALS Abstract Only
Frans J. M. Rietmeijer *In* NASA, Ames Research Center, Carbon in the Galaxy: Studies from Earth and Space Apr. 1990 p 339-340 (For primary document see N90-27562 21-88)
Avail: NTIS HC A15/MF A02 CSCL 03B

N90-27593*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.
CARBON IN THE OUTER SOLAR SYSTEM Abstract Only
D. P. Simonelli, J. B. Pollack, and C. P. McKay *In its* Carbon in

the Galaxy: Studies from Earth and Space Apr. 1990 p 342-343 (For primary document see N90-27562 21-88)
Avail: NTIS HC A15/MF A02 CSCL 03B

91 LUNAR AND PLANETARY EXPLORATION

Includes planetology; and manned and unmanned flights. For spacecraft design or space stations see *18 Spacecraft Design, Testing and Performance.*

N90-27604*# Lunar and Planetary Inst., Houston, TX.
MECA WORKSHOP ON DUST ON MARS 3
Steven Lee, ed. 1989 69 p Workshop held in Estes Park, CO, 21-23 Sep. 1988
(Contract NASw-4066)
(NASA-CR-185065; NAS 1.26:185065; LPI-89-01) Avail: NTIS HC A04/MF A01 CSCL 03B

Articles and abstracts of articles presented at this workshop are given. It was the goal of the workshop to stimulate cooperative research on, and discussion of, dust related processes on Mars, and to provide background information and help in planning of the Mars Observer mission. These topics are considered: How is dust ejected from the Martian surface into the atmosphere; How does the global atmospheric circulation affect the redistribution of dust on Mars; Are there sources and sinks of dust on Mars, if so, where are they and how do they vary in time; and How many components of dust are there on Mars, and what are their properties. There were four primary discussion sessions: (1) Dust in the atmosphere; (2) Dust on the surface; (3) Dust properties; and (4) Dust observations from future spacecraft missions. E.R.

N90-27605*# Pennsylvania Univ., Philadelphia. Dept. of Astronomy and Astrophysics.
ABSOLUTE WIND MEASUREMENTS IN THE LOWER THERMOSPHERE OF VENUS USING INFRARED HETERODYNE SPECTROSCOPY
Jeffrey J. Goldstein Washington, DC NASA May 1990 424 p
(Grant NGT-39-090-800)
(NASA-CR-4290; NAS 1.26:4290; Rept-90B00094) Avail: NTIS HC A18/MF A03 CSCL 03B

The first absolute wind velocities above the Venusian cloud-tops were obtained using NASA/Goddard infrared heterodyne spectrometers at the NASA Infrared Telescope Facility (IRTF) and the McMath Solar Telescope. Beam-integrated Doppler displacements in the non-thermal emission core of (12)C(16)O2 10.33 micron R(8) sampled the line of sight projection of the lower thermospheric wind field (100 to 120 km). A field-usable Lamb-dip laser stabilization system, developed for spectrometer absolute frequency calibration to less than + or - 0.1 MHz, allowed S/N-limited line of sight velocity resolution at the 1 m/s level. The spectrometer's diffraction-limited beam (1.7 arc-second HPBW at McMath, 0.9 arc-second HPBW at IRTF), and 1 to 2 arc-second seeing, provided the spatial resolution necessary for circulation model discrimination. Qualitative analysis of beam-integrated winds provided definitive evidence of a dominant subsolar-antisolar circulation in the lower thermosphere. Beam-integrated winds were modelled with a 100x100 grid over the beam, incorporating beam spatial rolloff and across-the-beam gradients in non-thermal emission intensity, line of sight projection geometry, and horizontal wind velocity. Horizontal wind velocity was derived from a 2-parameter model wind field comprised of subsolar-antisolar and zonal components. Best-fit models indicated a dominant subsolar-antisolar flow with 120 m/s cross-terminator winds and a retrograde zonal component with a 25 m/s equatorial velocity. A review of all dynamical indicators above the cloud-tops allowed development of an integrated and self-consistent picture of circulation in the 70 to 200 km range. Author

N90-27606*# National Aeronautics and Space Administration, Washington, DC.
REPORTS OF PLANETARY GEOLOGY AND GEOPHYSICS PROGRAM, 1989
Henry Holt, ed. Jul. 1990 623 p
(NASA-TM-4210; NAS 1.15:4210) Avail: NTIS HC A99/MF A04 CSCL 03A

Abstracts of reports from Principal Investigators of NASA's Planetary Geology and Geophysics Program are compiled. The research conducted under this program during 1989 is summarized. Each report includes significant accomplishments in the area of the author's funded grant or contract. Author

N90-27607*# Arizona State Univ., Tempe. Dept. of Geology.
MARS LANDING SITE CATALOG
Ronald Greeley, ed. Washington NASA Aug. 1990 202 p
(Grant NAGw-1306)
(NASA-RP-1238; NAS 1.61:1238) Avail: NTIS HC A10/MF A02 CSCL 03B

The catalog was compiled from material provided by the planetary community for areas on Mars that are of potential interest for future exploration. The catalog has been edited for consistency insofar as practical; however, the proposed scientific objectives and characteristics have not been reviewed. This is a working catalog that is being revised, updated, and expanded continually. Author

92 SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots.
For related information see *93 Space Radiation.*

N90-27608 Arizona Univ., Tucson.
NONLINEAR MULTI-MODE COUPLING OF THE SOLAR GRAVITY MODES IN A ROTATIONALLY SPLIT MULTIPLET Ph.D. Thesis
William Michael Czarnowski 1989 316 p
Avail: Univ. Microfilms Order No. DA8919026

Nonlinear properties of gravity-mode oscillations in the solar interior are explored. In particular, the interactions among the nonradial modes of a single rotationally split multiplet are emphasized. It investigates the multi-mode coupling of a large number (typically about 20) of the modes in a multiplet. Many internal resonances occur in a given problem, and the effects occur at third order. Motivation for this analysis arises both from general theoretical interest and from observed properties of the Sun that have recently become available. Observations of solar gravity-mode oscillation eigenfrequencies and eigenfunctions obtained at the Santa Catalina Laboratory for Experimental Relativity by Astrometry (SCLERA) show strong evidence of nonlinear effects. A general theoretical framework is provided for investigating many problems of second and third-order mode coupling in stellar systems. A multiple-scale perturbation technique is used. The formalism presents an alternative to that of Dziembowski (1982), and is more generally applicable. The theory provides a means to infer the core amplitudes of the gravity-modes exhibiting the nonlinear behavior in the SCLERA data. As a byproduct of the analysis, certain characteristics of the data used in conjunction with the theory allow the possibility of determining the linear damping time of these modes. As with the amplitudes, traditional approaches are bypassed, thus providing a novel and independent determination. Very preliminary results seem to indicate a typical damping time of about 40 years. Author

N90-27609*# Lunar and Planetary Inst., Houston, TX.
MEVTV WORKSHOP ON TECTONIC FEATURES ON MARS
Thomas R. Watters, ed. and Matthew P. Golombek, ed. 1989 125 p Workshop held in Richland, WA, 20-22 Apr. 1989
(Contract NASw-4066)
(NASA-CR-186143; NAS 1.26:186143; LPI-TR-89-06) Avail: NTIS HC A06/MF A01 CSCL 03B

The state of knowledge of tectonic features on Mars was determined and kinematic and mechanical models were assessed for their origin. Three sessions were held: wrinkle ridges and compressional structure; strike-slip faults; and extensional structures. Each session began with an overview of the features under discussion. In the case of wrinkle ridges and extensional structures, the overview was followed by keynote addresses by specialists working on similar structures on the Earth. The first session of the workshop focused on the controversy over the relative importance of folding, faulting, and intrusive volcanism in the origin of wrinkle ridges. The session ended with discussions of the origin of compressional flank structures associated with Martian volcanoes and the relationship between the volcanic complexes and the inferred regional stress field. The second day of the workshop began with the presentation and discussion of evidence for strike-slip faults on Mars at various scales. In the last session, the discussion of extensional structures ranged from the origin of grabens, tension cracks, and pit-crater chains to the origin of Valles Marineris canyons. Shear and tensile modes of brittle failure in the formation of extensional features and the role of these failure modes in the formation of pit-crater chains and the canyons of Valles Marineris were debated. The relationship of extensional features to other surface processes, such as carbonate dissolution (karst) were also discussed. Author

N90-27610# Arizona Univ., Tucson. Dept. of Physics.
APPLICATION OF SOLAR SEISMOLOGY TO STUDY OF THE CONVECTION ZONE Final Technical Report, 1 Jan. 1987 - 31 Dec. 1989
Henry A. Hill 9 May 1990 14 p
(Grant AF-AFOSR-0105-87; AF Proj. 2311)
(AD-A221975; AFOSR-90-0553TR) Avail: NTIS HC A03/MF A01 CSCL 03/2

Progress has been made in the program to use solar seismology as a tool for understanding, and potentially, forecasting solar variability. Changes in the velocity of sound profile and nonadiabatic effects in the internal equilibrium condition of the convection zone over a six year period have been inferred from observed changes in the frequencies of low-order acoustic moses and intermediate degree f-modes. These changes may be associated with the eleven year solar cycle. The observed spectrum of gravity-modes has been used to infer a discontinuity in the mean molecular weight in the Sun's core and to place an upper limit on the density of WIMPS (Weakly Interacting Massive Particles) proposed to explain the solar neutrino paradox. The interred upper limit, if confirmed in future work removes the WIMPS proposal as a viable option. Evidence for gravity-mode coupling has been extended from 4 multiplets to 20. This evidence for mode coupling leads to interesting predictions concerning the solar neutrino flux. New differential radius observations were obtained in 1988 and 1989. GRA

93 SPACE RADIATION

Includes cosmic radiation; and inner and outer earth's radiation belts.

For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

No abstracts in this category.

99 GENERAL

N90-27611# Los Alamos National Lab., NM.
CHEMICAL AND LASER SCIENCES DIVISION Annual Report, 1989
N. Haines, ed. Jun. 1990 129 p
(Contract W-7405-eng-36)
(DE90-013532; LA-11833-PR; UC-900) Avail: NTIS HC A07/MF A01

The Chemical and Laser Sciences Division Annual Report includes articles describing representative research and development activities within the Division, as well as major programs to which the Division makes significant contributions. DOE

N90-27612# Navy Personnel Research and Development Center, San Diego, CA.
INDEPENDENT RESEARCH AND INDEPENDENT EXPLORATORY DEVELOPMENT PROGRAMS Annual Report, FY 1989
William E. Montague, ed. and Carmen C. Scheifers, ed. Mar. 1990 87 p
(AD-A222690; NPRDC-AP-90-6) Avail: NTIS HC A05/MF A01 CSCL 05/1

The Acting Technical Director encourages scientists and engineers at the Navy Personnel Research and Development Center (NPRDC) to generate new and innovative proposals to promote scientific and technological growth in the organization and the development of knowledge and technology of interest to the Navy. Support for this provided by discretionary funding furnished by the Independent Research (IR) and Independent Exploratory Development (IED) programs of the Office of Naval Research and Office of Naval Technology. These programs support initial research and development of interest to the Navy with emphasis on the NPRDC mission areas of the acquisition, training, and effective utilization of personnel. Funds are provided to the Technical Directors of Navy Laboratories to support innovative and promising research and development outside the procedures required under normal funding authorization. The funds are to encourage creative efforts important to mission accomplishment. They enable promising researchers to spend a portion of their time on examining the feasibility of self-generated new ideas and scientific advances. They can provide important and rapid test of promising new technology and can help fill gaps in the research and development program. This may involve preliminary work on speculative solutions too risky to be funded from existing programs. GRA

N90-27613# Universal Energy Systems, Inc., Dayton, OH.
UNITED STATES AIR FORCE RESEARCH INITIATION PROGRAM FOR 1988, VOLUME 1
Rodney C. Darrah and Claude Cavender Apr. 1990 976 p
(Contract F49620-88-C-0053)
(AD-A223123; AFOSR-90-0707TR-Vol-1) Avail: NTIS HC A99/MF E09 CSCL 05/2

Papers from this program are presented. Some titles are: Synergistic effects of bomb cratering; Automated motion parameter determination from an image sequence; Modeling and simulation on microcomputers, 1989; Two dimensional MHD simulation of accelerating arc plasmas; Modeling reactive fragments; Target-aerosol discrimination for active optical proximity sensors; The dynamics of impact; Multigraph kernel for transputer based systems; MTF studies of IR focal plane arrays at low flux levels; Droplet size distributions and combustion modeling in a pintle injector spray; Multiple scattering in solid fuel rocket plumes; Influence of forced disturbances on the vortex core and the vortex burst; Large space structure parameter estimation; Calibration of the infrared spectropolarimeter; Computer code to include core polarization in effective potential basis set expansion studies; Fluorescence spectra of matrix-isolated lithium; Energy-and time-resolved photophysics and photochemistry of high energy cryogenic metal-containing rocket fuels; Experimental verification and development of structural identification techniques on a grid; Experimental investigation of the stability of jets near the critical point; HF network evaluation; High intensity compressive stress wave propagation through unsaturated sands. GRA

N90-27614# Universal Energy Systems, Inc., Dayton, OH.
UNITED STATES AIR FORCE RESEARCH INITIATION PROGRAM FOR 1988, VOLUME 2
Rodney C. Darrah and Claude Cavender Apr. 1990 604 p
(Contract F49620-88-C-0053)
(AD-A223124; AFOSR-90-0708TR-Vol-2) Avail: NTIS HC
A99/MF A04 CSCL 05/2

Papers from this program are presented. Some titles are: NMR studies of alkylammonium chloroaluminate room temperature electrolytes; Mechanistic studies on the thermal decomposition of NTO by high performance liquid chromatography; Aromatic nitrations in chloroaluminate melts; Calculated C-NO2 bond dissociation energies A MCSCF study of the rearrangement of nitromethane to methyl nitrate; Sodium as an electrode for chloroaluminate; Transient shock waves in a Mach 3 flow; Ab-initio and semi-empirical molecular orbital studies of energetic materials (Nitrogen heterocyclics) and polymers; Radiative association in ion-molecule reactions (Reactions of some carbon cations); Impulse approximation formalism for atom molecule collisions; Stellar photometry, vehicle glow, and advanced image analysis; Theoretical and observational studies of geomagnetic storm-related ion and electron heating in the subauroral region; Algorithms for generalized exponential inversion; Trajectory calculations of high temperature and kinetic energy dependent ion-polar molecule collision rate constants; Aging studies of GaAs Schottky barriers; Supply line testing in CMOS digital circuits; Characterization of detectors for optical pattern recognition. GRA

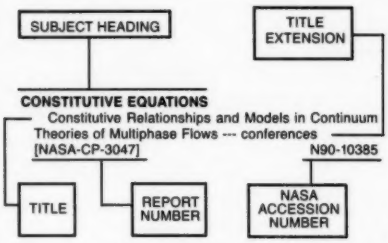
N90-27615# Universal Energy Systems, Inc., Dayton, OH.
UNITED STATES AIR FORCE RESEARCH INITIATION PROGRAM FOR 1988, VOLUME 3
Rodney C. Darrah and Claude Cavender Apr. 1990 1050 p
(Contract F49620-88-C-0053)
(AD-A223125; AFOSR-90-0709TR-Vol-3) Avail: NTIS HC
A99/MF E09 CSCL 05/2

Papers from this program are presented. Some titles are: Vaporization behavior of pure and multicomponent fuel droplets in a hot air stream; Vortical structures in a 2-D slot burner-cold flow; Calculations of interface-state occupation function and GaAs/Ge heterostructure solar cell efficiency; Computer simulation of adaptive resource management in real time; Proving equivalence of high and low level architectural descriptions in VHDL; Applications of evolutionary learning strategies to pattern recognition tasks; Effect of roughened surface on turbulent boundary layer separation at Mach 6.0; Stochastic model of fatigue crack growth due to random loading for application to aircraft wheels; Fatigue characteristics of F-16 composite transparency material determined by long term and accelerated methods; Convergence of upper-bound optimum design of large scale structures with specified frequency bands; Robustness with positive real controllers for large space structures; Robust eigenstructure assignment for flight control design; Comparative burning rates and duplex loads of solid propellants; Low velocity impact of composite materials; Aircraft availability model (Feasibility study for POM forecasting); Tunable absorption in doping superlattices; Joining of carbon-carbon composites; Characterization of the phase separation behavior of poly(p-phenylene benzobisthizole)/ Amorphous nylon molecular composites by small angle light scattering. GRA

N90-27616# Universal Energy Systems, Inc., Dayton, OH.
UNITED STATES AIR FORCE RESEARCH INITIATION PROGRAM FOR 1988, VOLUME 4
Rodney C. Darrah and Claude Cavender Apr. 1990 990 p
(Contract F49620-88-C-0053)
(AD-A223126; AFOSR-90-0710TR-Vol-4) Avail: NTIS HC
A99/MF E09 CSCL 05/2

Papers from this program are presented. Some titles are: Auditory modeling; Assessing the cognitive demands of tracking strategies; Optimization of the nonlinear discrete parameter model of the seated human spine; In vitro modeling of perfluoro-N-decanoate effects on enzymes of fatty acid metabolism; Investigation of training content validity and training efficiency in the Air Force airmen basic-in-residence training course; Intelligent tool to facilitate development of qualitative process models in novice programmers; Effect of range restriction on correlation coefficient estimation; validation of an enlisted Air Force specialty task taxonomy and cross-AFS ease-of-movement predictions; Proportional intensity reliability analysis for repairable items; Monte Carlo comparison of validity generalization procedures; Graphical programming of simulation models in an object-oriented environment; Refinement considerations for an advanced instructional design advisor; engineering design with decision support (An application of goal decomposition); Solvent extraction of boron from industrial wastewaters; Comparison of asbestos analysis by SEM-EDXA and TEM-SAED; Examination of Kriging techniques for ground water monitoring; Cortisol prevention of chronic beryllium disease in postpartum rats; Blood flow distribution in the non-working forearm during exercise. GRA

Typical Subject Index Listing



The subject heading is a key to the subject content of the document. Titles, report numbers, and accession numbers of pertinent documents are provided under each subject heading. When the title is insufficiently descriptive of the document content, a title extension has been added, separated from the title by three hyphens. The report number helps to indicate the type of document cited (e.g., NASA report, NASA translation, NASA contractor report). The NASA accession number is the number by which the document abstracts are arranged in this journal and by which the document is sold or requested. The titles, with title extensions if present, are arranged under each subject heading in ascending accession number order. The subject headings have been selected from the latest revision of the *NASA Thesaurus* (NASA SP-7064).

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Information resources management, 1984-1989: A bibliography with indexes
[NASA-SP-7079] N90-27548
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[AD-A221644] N90-27559

BICRYSTALS
Application of microdesigned interfaces to studies of ceramic processing
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[DE90-011108] N90-27343
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[AD-A221766] N90-27427
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Report of the Defense Science Board 1989 summer study on national space launch strategy
[AD-A222419] N90-26848
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[NASA-CR-183952] N90-26870
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[AD-A223125] N90-27615
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[AD-A222517] N90-27234
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[AD-A223242] N90-27076
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[IAR-89-3] N90-27068
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[AD-A222222] N90-27597
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[AD-A221938] N90-27596
CANADA
Command and control in the age of space-based surveillance N90-27445
Authors guide to the publishing procedures at Defence Research Establishment Suffield
[AD-A223101] N90-27554
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Modeling and measurement of tree canopy reflectance
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[DE90-012231] N90-26936
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United States Air Force research initiation program for 1988, volume 3
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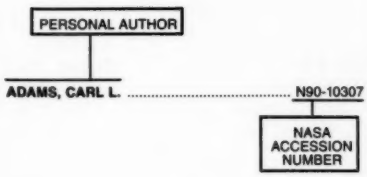

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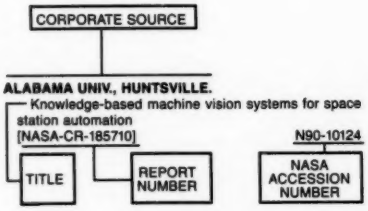

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Advanced ceramic armor materials
[AD-A223227] N90-26970
COSTRUZIONI AERONAUTICHE GIOVANNI AGUSTA S.P.A., CASCINA COSTA (ITALY).
Development of a method to design helicopter rotors
[REPT-100-30-03] N90-26830
Design of helicopter components in metal matrix composites
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CRYSTALLUME, MENLO PARK, CA.
Polycrystalline diamond Junction Field Effect Transistors (JFETS)
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DALHOUSIE UNIV., HALIFAX (NOVA SCOTIA).
Field-induced surface chemistry of NO
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Installation and pretest analysis of DARPA suboff model in the DTRC anechoic wind tunnel
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A framework to correlate a/W ratio effects on elastic-plastic fracture toughness (J (sub c))
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B-1B improved windshield development. Volume 2: Magna analysis: Baseline and parametric
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Dynamic properties of porous B4C
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Automatic information processing and high performance skills: Application to training
[AD-A221709] N90-27259
DEFENCE RESEARCH ESTABLISHMENT ATLANTIC, DARTMOUTH (NOVA SCOTIA).
Post script code for grey-scaled displays
[AD-A223099] N90-27354
Noise from tip vortex and bubble cavitation
[AD-A221962] N90-27488
DEFENCE RESEARCH ESTABLISHMENT, OTTAWA (ONTARIO).
An algorithm for automated surface modelling in unigraphics
[AD-A223219] N90-27355
Modification of a cam facility
[AD-A221828] N90-27376
DEFENCE RESEARCH ESTABLISHMENT SUFFIELD, RALSTON (ALBERTA).
Authors guide to the publishing procedures at Defence Research Establishment Suffield
[AD-A223101] N90-27554
DEFENSE COMMUNICATIONS AGENCY, WASHINGTON, DC.
The post-2000 MILSATCOM architecture N90-27452
DEFENSE SYSTEMS MANAGEMENT SCHOOL, FORT BELVOIR, VA.
Systems engineering management guide
[AD-A223168] N90-27544
DEPARTMENT OF ENERGY, WASHINGTON, DC.
Hydrogen Energy Coordinating Committee summary of DOE hydrogen programs for FY 1988
[DOE/CE-0242] N90-26989
Electric and hybrid vehicles program
[DE90-013560] N90-27043
Electric vehicle battery R/D in the context of a propulsion system
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DEPARTMENT OF THE NAVY, WASHINGTON, DC.
Underwater connect and disconnect plug and receptacle
[AD-D014175] N90-27039
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DEUTSCHE FORSCHUNGS- UND VERSUCHSANSTALT FUER LUFT- UND RAUMFAHRT, GOETTINGEN (GERMANY, F.R.).
Adaptation for unsteady flow N90-26845
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Design of robust multivariable controllers
[AD-A222096] N90-27397

E

EA ENGINEERING SCIENCE AND TECHNOLOGY, INC., LAFAYETTE, CA.
Enhanced bioreclamation of jet fuels: A full-scale test at Eglin AFB, Florida
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EG AND G ENERGY MEASUREMENTS, INC., LOS ALAMOS, NM.
Crossed-microwave-beam air ionization laboratory experiments
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ELECTRONICS RESEARCH LAB., ADELAIDE (AUSTRALIA).
Meteor burst communications systems
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ENVIRONMENTAL PROTECTION AGENCY, RESEARCH TRIANGLE PARK, NC.
Neurobehavioral effects of carbon monoxide (CO) exposure in humans: Elevated carboxyhemoglobin (COHb) and cerebrovascular responses
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ESSEX CORP., HUNTSVILLE, AL.
Payload training methodology study
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EUROPEAN OFFICE OF AEROSPACE RESEARCH AND DEVELOPMENT, LONDON (ENGLAND).
Accurate determination of the complex permittivity of biological tissue at 90 GHz, 70 GHz, and over a broad band around 35 GHz
[AD-A222062] N90-27240

EUROPEAN SPACE AGENCY, PARIS (FRANCE).
ECOS: The ESA Costing Software
[ESA-BR-56] N90-27274

F

FEDERAL AVIATION ADMINISTRATION, ATLANTIC CITY, NJ.
Dallas/Fort Worth simulation, volume 1
[DOT/FAA/CT-TN89/28-VOL-1] N90-26802
Data link test and analysis system/ATCRBS transponder test system technical reference
[DOT/FAA/CT-TN90/7] N90-26803
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Federal Aviation Administration small business innovation research 5-year project summaries
[AD-A221590] N90-27546
FINNISH METEOROLOGICAL INST., HELSINKI.
Proceedings of the International Workshop on Geomagnetic Observatory Data Acquisition and Processing
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FLORIDA STATE UNIV., TALLAHASSEE.
A hypothesis test of cumulative sums of multinomial parameters
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ROBFIT: A code for the analysis of histogram spectra with nonlinear regression and robust estimation
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FLORIDA UNIV., GAINESVILLE.
Resonance enhanced two-laser infrared multiple photon dissociation of gaseous ions
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FRAUNHOFER-GESELLSCHAFT ZUR FOERDERUNG DER ANGEWANDTEN FORSCHUNG E.V., FREIBURG (GERMANY, F.R.).
An optical study of the flow start-up process in four convergent-divergent nozzles
[AD-A222918] N90-26846

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Experiments at high elongations in DIII-D
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GEOLOGICAL SURVEY, RESTON, VA.
National mapping program. Fact sheet: Black and white photographs. NHAP (National High Altitude Photography Program)
[PB90-185042] N90-27139
GEOLOGICAL SURVEY OF CANADA, OTTAWA (ONTARIO).
Some thoughts on data processing N90-27189
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Improved computational strategy for predicting the response of complex systems
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The 1990 Gordon Research Conference on Composites
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[AD-A223218] N90-27531
GRENOBLE-1 UNIV. (FRANCE).
Study of the feasibility of several mixtures
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HEBREW UNIV., JERUSALEM (ISRAEL).
Preparation and characterization of thin films based on sol-gel technique and development of spectroscopic probe for film formation and characterization
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HIROSHIMA UNIV., TAKEHARA (JAPAN).
Proceedings of workshop on Dark Matter and the Structure of the Universe
[DE90-791308] N90-27602
HONEYWELL, INC., MINNEAPOLIS, MN.
Attitude Determination and Control System (ADCS) and Maintenance and Diagnostic System (MDS): A maintenance and diagnostic system for Space Station Freedom N90-27295
HOUSTON UNIV., CLEAR LAKE, TX.
Communications and tracking expert systems study
[NASA-CR-185935] N90-27004
IRDS prototyping with applications to the representation of EA/RA models
[NASA-CR-186066] N90-27273
Robotic space simulation integration of vision algorithms into an orbital operations simulation
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HOWARD UNIV., WASHINGTON, DC.
Control of orbiting large space structural systems with discrete time observational data and random measurement noise
[AD-A222476] N90-26863
HULBURT (E. O.) CENTER FOR SPACE RESEARCH, WASHINGTON, DC.
EINMUF: An HF MUF, FOT, LUF prediction program
[AD-A221577] N90-27371

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IDAHO NATIONAL ENGINEERING LAB., IDAHO FALLS.
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[DE90-000322] N90-27163
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Data and analysis center for software
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[NASA-CR-185341] N90-27348
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INDIANA UNIV., BLOOMINGTON.
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[AD-A221795] N90-27083
INSTITUT DE PHYSIQUE DU GLOBE, PARIS (FRANCE).
A new method for the absolute measurement of geomagnetism beginning with DI Flux N90-27182
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About the derivation of geomagnetic indices from digital data N90-27191
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Interim status and recommendations for the Engineering Information System (EIS) program
[AD-A222060] N90-27555
INSTITUTE FOR PERCEPTION RVO-TNO, SOESTERBERG (NETHERLANDS).
Quality evaluation of speech processing systems N90-27012
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Compiling knowledge-based systems from KEE to Ada N90-27334
INTERNATIONAL BUSINESS MACHINES CORP., SAN JOSE, CA.
Phase-sensitive optical detection of ballistic phonon pulses using frequency-modulation spectroscopy and persistent spectral holes
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Ultrasensitive laser spectroscopy in solids: Statistical fine structure and single-molecule detection
[AD-A222391] N90-27477
ISTITUTO NAZIONALE DI GEOFISICA, ROME (ITALY).
Improvements of automatic magnetic observatories in Italy N90-27185

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A study on the heating and diagnostic of a tokamak plasma by electromagnetic waves of the electron cyclotron range of frequencies
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JAPAN ATOMIC ENERGY RESEARCH INST., TOKAI.
Filler metal development for Hastelloy alloy XR
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JAPAN METEOROLOGICAL AGENCY, TOKYO.
An experiment to make a new design of the Satellite Cloud Information Chart with the combination of visible and infrared data observed by the GMS N90-27223
JAPAN SOLAR ENERGY SOCIETY, TOKYO.
Abstracts of 1989 Japan Solar Energy Society and Japan Wind Energy Association Joint Conference
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JAPAN WIND ENERGY ASSOCIATION, TOKYO.
Abstracts of 1989 Japan Solar Energy Society and Japan Wind Energy Association Joint Conference
[DE90-503616] N90-27168

JET PROPULSION LAB., CALIFORNIA INST. OF TECH., PASADENA.
New core design for use with precision composite reflectors
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Silicon containing electroconductive polymers and structures made therefrom
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JOHNS HOPKINS UNIV., BALTIMORE, MD.
Analysis and design methods for nonlinear control systems
[AD-A221621] N90-27404

JOHNS HOPKINS UNIV., LAUREL, MD.
Advanced propulsion concepts
[NASA-CR-185920] N90-26872
Space Propulsion Hazards Analysis Manual (SPHAM), volume 1
[AD-A219607] N90-26874
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[AD-A219608] N90-26875
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K

KENT STATE UNIV., OH.
Investigations on improved iterative methods for solving sparse systems of linear equations
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KERNFORSCHUNGSZENTRUM G.M.B.H., KARLSRUHE (GERMANY, F.R.).
Coulomb-dissociation of 156 MeV 6Li-projectiles
[KFK-4691] N90-27482

KINGS COLL., LONDON (ENGLAND).
Accurate determination of the complex permittivity of biological tissue at 90 GHz, 70 GHz, and over a broad band around 35 GHz
[AD-A222062] N90-27240

KTAADN, INC., NEWTON, MA.
Evaluation of correlations between meteorological measurements and observations of lightning activity using artificial neural systems
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L

LA PLATA UNIV. (ARGENTINA).
Pulsed laser deposition of high (Tc) superconducting thin films: Present and future
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LAWRENCE LIVERMORE NATIONAL LAB., CA.
Aspects of acoustic noise generation by a laser-propelled vehicle
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Studies of ECCM improvements for frequency-hopping CPFSK systems
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LEHIGH UNIV., BETHLEHEM, PA.
Vortex-induced boundary layer separation
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LOCKHEED ENGINEERING AND SCIENCES CO., HAMPTON, VA.
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Computerized corrosion forecasting model for C-5 aircraft N90-26815

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Ilmenite exsolution schemes in Apollo-17 high-Ti basalts
[DE90-011992] N90-26912
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LOUISIANA STATE UNIV., BATON ROUGE.
Nonlinear real-time signal processing
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LUNAR AND PLANETARY INST., HOUSTON, TX.
MEVTV Workshop on Early Tectonic and Volcanic Evolution of Mars
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[NASA-CR-185065] N90-27604
MEVTV Workshop on Tectonic Features on Mars
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M

MACDONALD, DETTWILER AND ASSOCIATES LTD., RICHMOND (BRITISH COLUMBIA).
Command and control in the age of space-based surveillance N90-27445

MARCONI SPEECH AND INFORMATION SYSTEMS, PORTSMOUTH (ENGLAND).
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MARTIN MARIETTA AEROSPACE, DENVER, CO.
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Finding minimum width for single-layer channel routing in linear time
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MASSACHUSETTS INST. OF TECH., CAMBRIDGE.
Local design methodologies for a hierarchic control architecture
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MASSACHUSETTS INST. OF TECH., LEXINGTON.
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New observations of interstellar organic molecules N90-27587

MASSACHUSETTS UNIV., WORCESTER.
Non-linear analysis of visual cortical neurons
[AD-A221543] N90-27250

MAX-PLANCK-INST. FUER PHYSIK UND ASTROPHYSIK, GARCHING (GERMANY, F.R.).
Activities report of the Werner-Heisenberg Institute for Physics, Munich, Federal Republic of Germany
[ISSN-0173-6256] N90-27481

MAX-PLANCK-INST. FUER STROEMUNGSFORSCHUNG, GOETTINGEN (GERMANY, F.R.).
Particle size distribution determined from measured scattered light
[MPIS-5/1990] N90-27497

MCDONNELL AIRCRAFT CO., SAINT LOUIS, MO.
Damage tolerance analysis for manned hypervelocity vehicles. Volume 2: Software user's manual
[AD-A222136] N90-26826
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An expert system advisor for damage repair of composite wing skins (repairman) N90-26810
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Curvature estimation in orientation selection
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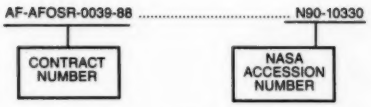

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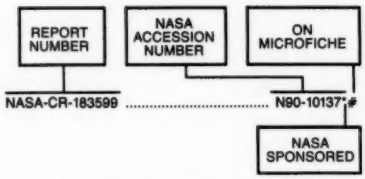

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NAS 1.60:2943 ..... N90-27121* #
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NAS 1.61:1238 ..... N90-27607* #
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NAS 1.71:LAR-14033-1 ..... N90-27072* #
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NAS 1.71:LAR-14078-1-CU ..... N90-27071* #
NAS 1.71:LAR-14142-1 ..... N90-27116* #
NAS 1.71:LAR-14145-1 ..... N90-26954* #
NAS 1.71:LAR-14159-1-CU ..... N90-26953* #
NAS 1.71:LAR-14198-1 ..... N90-26956* #
NAS 1.71:LAR-14250-1-SB ..... N90-27472* #
NAS 1.71:LAR-14338-1 ..... N90-26881* #
NAS 1.71:LAR-14339-1 ..... N90-26955* #
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NAS 1.71:MFS-28013-4 ..... N90-27595* #
NAS 1.71:MFS-28384-1 ..... N90-27112* #
NAS 1.71:MFS-28420-1 ..... N90-27113* #
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NAS 1.71:MFS-28426-1 ..... N90-27261* #
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NAS 1.71:MSC-21420-1 ..... N90-26858* #
NAS 1.71:MSC-21504-1 ..... N90-26859* #
NAS 1.71:MSC-21534-1 ..... N90-26860* #
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NASA-CASE-MFS-28426-1 ..... N90-27261* #

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NASA-CASE-NPO-17724-1-CU ..... N90-27517* #
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NASA-CASE-NPO-17911-1-CU ..... N90-27016* #
NASA-CASE-NPO-17913-1-CU ..... N90-27488* #

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NASA-CP-3072 ..... N90-27140* #
NASA-CP-3073 ..... N90-27275* #

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NASA-CR-4287 ..... N90-27122* #
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NASA-CR-183803 ..... N90-26935* #
NASA-CR-183907 ..... N90-26849* #
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NASA-CR-184804 ..... N90-27175* #
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NASA-CR-186935 ..... N90-26963* #
NASA-CR-186949 ..... N90-26971* #
NASA-CR-186950 ..... N90-26869* #
NASA-CR-186952 ..... N90-27108* #

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NASA-TM-893470 ..... N90-27553* #

NASA-TP-2943 ..... N90-27121* #
NASA-TP-2951 ..... N90-26823* #
NASA-TP-3018 ..... N90-27066* #

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NISTIR-89/3928 ..... N90-26837 #
NISTIR-89/4171 ..... N90-26871* #
NISTIR-89/4211 ..... N90-27067 #
NISTIR-89/4223 ..... N90-27109 #

NLR-MP-88055-U ..... N90-27069 #

NLR-TP-89127-U ..... N90-26857 #

NMAB-445 ..... N90-26963* #
NMAB-449 ..... N90-27049* #
NMAB-453 ..... N90-26971* #

NMRI-90-14 ..... N90-27247 #
NMRI-90-16 ..... N90-26972 #

NOSC/TD-1670 ..... N90-27374 #
NOSC/TD-1752 ..... N90-27208 #
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NRL-MR-6622 ..... N90-27107 #
NRL-MR-6623 ..... N90-27101 #
NRL-MR-6630 ..... N90-26796 #
NRL-MR-6633 ..... N90-26948 #
NRL-MR-6636 ..... N90-27507 #
NRL-MR-6638 ..... N90-27034 #
NRL-MR-6645 ..... N90-27371 #
NRL-MR-6646 ..... N90-26878 #

NRL-PUB-167-6320 ..... N90-26945 #

NSWC-TR-89-97 ..... N90-27370 #
NSWC-TR-90-48 ..... N90-27539 #

NSWC/TR-89-338 ..... N90-27532 #

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OSU/DGSS-RF-765306/718188 ..... N90-27201 #

OSURF-765285/718164 ..... N90-26917 #

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PB90-148362 ..... N90-26871* #
PB90-151309 ..... N90-27547 #
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PB90-160383 ..... N90-27109 #
PB90-162009 ..... N90-27067 #
PB90-182742 ..... N90-27005 #
PB90-183658 ..... N90-26950 #
PB90-185042 ..... N90-27139 #
PB90-186826 ..... N90-27226 #
PB90-189432 ..... N90-26910 #

PCG-17 ..... N90-27265 #

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REPT-100-30-03 ..... N90-26830 #
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RR-779-I ..... N90-27380 #

RRK-89-28 ..... N90-27602 #

RSRE-MEMO-4356 ..... N90-27360 #

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SAF/AQT-SR-90-007 ..... N90-27552* #
SAF/AQT-SR-90-008 ..... N90-27553* #

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SAND-89-2479C ..... N90-27096 #
SAND-90-0047C ..... N90-27017 #
SAND-90-0163 ..... N90-27485 #
SAND-90-0483 ..... N90-27345 #
SAND-90-1228C ..... N90-27514 #

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SC5508.FR ..... N90-26978 #

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SDL/89-083 ..... N90-26869* #

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SERI/TP-253-3668 ..... N90-27166 #
SERI/TP-260-3674 ..... N90-27163 #

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TR-9 ..... N90-27542 #
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TR-14 ..... N90-27136 #
TR-17 ..... N90-26919 #
TR-18 ..... N90-27075 #
TR-18-ONR ..... N90-26926 #
TR-19 ..... N90-26916 #
TR-20 ..... N90-26975 #
TR-20-ONR ..... N90-27535 #
TR-24 ..... N90-27102 #
TR-24 ..... N90-27132 #
TR-25 ..... N90-26977 #
TR-25 ..... N90-27477 #
TR-25-ONR ..... N90-27172 #
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UC-900 ..... N90-27611 #

UCRL-CR-103654 ..... N90-27513 #

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UCRL-JC-103972 ..... N90-27409* #

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UCRL-100729 ..... N90-27486 #
UCRL-102303 ..... N90-26852 #
UCRL-102561 ..... N90-26851 #
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UCRL-102791 ..... N90-27342 #

UDR-TM-89-15 ..... N90-26960 #

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UDR-TR-90-57 ..... N90-26942 #

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UMIACS-TR-90-23 ..... N90-27367 #
UMIACS-TR-90-54 ..... N90-27386* #

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US-PATENT-APPL-503409 ..... N90-27041* #

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US-PATENT-CLASS-439-038 ..... N90-27039

US-PATENT-4,779,277 ..... N90-27095
US-PATENT-4,838,797 ..... N90-27039

USAARL-90-10 ..... N90-27263 #

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USAF-STINFO-CONTRIB-90/3 ..... N90-27552* #
USAF-STINFO-CONTRIB-90/4 ..... N90-27553* #

USAFA-TR-90-2 ..... N90-27413 #

USAFETAC/TN-90/002 ..... N90-27231 #

USAFSAM-TR-89-20 ..... N90-27240 #

UTRC/R90-917779-5 ..... N90-26893 #
UTRC/R90-957565-F ..... N90-27130 #

UVA/525701/AM90/101 ..... N90-26867 #

VPI-E-89-19 ..... N90-27122* #

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WRDC-TR-90-1080 ..... N90-27528 #
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WRDC-TR-90-3012 ..... N90-26863 #
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WRDC-TR-90-4023 ..... N90-26987 #
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WRDC-TR-90-5066 ..... N90-27427 #

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YALEU/DCS/RR-773 ..... N90-27420 #

Appendix—About STAR

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SUBJECT SCOPE

The subject scope of *STAR* and *IAA* includes all aspects of aeronautics and space research and development, supporting basic and applied research, and applications. Aerospace aspects of earth resources, energy development, conservation, oceanography, environmental protection, urban transportation, and other topics of high national priority are also covered.

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AERONAUTICS

Includes aeronautics (general); aerodynamics; air transportation and safety; aircraft communications and navigation; aircraft design, testing and performance; aircraft instrumentation; aircraft propulsion and power; aircraft stability and control; and research and support facilities (air).

For related information see also *Astronautics.*

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For related information see also *34 Fluid Mechanics and Heat Transfer.*

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